BLM LIBRARY
88034435

Forest Service

United States
Department of
the Interior

Bureau of Land
Management

July 1993

# Draft Supplemental Environmental Impact Statement

## on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl

# ABBREVIATIONS AND ACRONYMS

BLM LIBRARY
SC-653, BLDG. 50
DENVER FEDERAL CENTER
P. O. BOX 25047
DENVER, CO 80225-0047

| | |
|---|---|
| ACEC | Area of Critical Environmental Concern |
| ASQ | Allowable Sale Quantity |
| AUM | Animal Unit Month |
| BBF | Billion Board Feet |
| BLM | Bureau of Land Management (USDI) |
| BSIA | Botanical Special Interest Area |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| dbh | Diameter at Breast Height |
| DCA | Designated Conservation Area |
| EIS | Environmental Impact Statement |
| FEIS | Final Environmental Impact Statement |
| FEMAT | Forest Ecosystem Management Assessment Team |
| FLPMA | Federal Land Policy and Management Act |
| FSH | Forest Service Handbook |
| FSM | Forest Service Manual |
| FWS | U.S. Fish and Wildlife Service (USDI) |
| GIS | Geographic Information System |
| HCA | Habitat Conservation Area |
| ISC | Interagency Scientific Committee |
| LS/OG | Late-Successional and/or Old-Growth Forest |
| MFP | Management Framework Plan |
| MMBF | Million Board Feet |
| NEPA | National Environmental Policy Act of 1969 |
| NFMA | National Forest Management Act of 1976 |
| NMFS | National Marine Fisheries Service (U.S. Dept. of Commerce) |
| O&C | Oregon and California Railroad Company revested lands (see Glossary) |
| PSQ | Probable Sale Quantity |
| RD&A | Research, Development and Application |
| RMP | Resource Management Plan |
| RNA | Research Natural Area |
| ROD | Record of Decision |
| ROS | Recreation Opportunity Spectrum |
| SAS | Seattle Audubon Society |
| SAT | Scientific Analysis Team |
| SEIS | Supplemental Environmental Impact Statement |
| USDA | United States Department of Agriculture |
| USDI | United States Department of the Interior |

In this Supplemental Environmental Impact Statement, any reference to "owl" or "spotted owl" refers to the northern spotted owl (*Strix occidentalis caurina*) unless specifically identified as another species or subspecies. Any reference to "the Assessment Team" refers specifically to the Forest Ecosystem Management Assessment Team.

# Draft Supplemental Environmental Impact Statement
# on
# Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl

## Notice to Readers

The following information is provided to assist you in reviewing this environmental impact statement and participating in the public comment process.

- This Draft Supplemental Environmental Impact Statement (SEIS) discloses the environmental effects of 10 alternatives for managing old-growth and late-successional forests. The alternatives apply only to the lands administered by the Bureau of Land Management (BLM) and Forest Service in the Pacific Northwest and northern California within the range of the northern spotted owl. Alternative 9 is identified as the preferred alternative and presents information on the forest plan announced by President Clinton on July 1, 1993.

- You may be receiving two separate packages. Because they were printed by different printers, they were mailed separately. One package will contain the Draft SEIS and a packet of maps. The other contains Appendix A — the complete report of the Forest Ecosystem Management Assessment Team. If you requested "Appendices" on the document request form you mailed in, you should be receiving both soon. If you did not request both, you will only receive the environmental impact statement and the maps.

- Appendix A of this document is *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment*. It is the report of the Assessment Team led by Dr. Jack Ward Thomas and is referred to as the FEMAT Report. If you want to review the 1,000 page Appendix A but did not request appendices, you will find copies at your local Bureau of Land Management or Forest Service office in Oregon, Washington, and northern California. Copies are also available in some public libraries. Alternatively, you may request copies by writing the Interagency SEIS Team at the address below or by calling 503-326-7883.

- Scientific terms and acronyms are defined in the Glossaries.

- The comment period for this draft document ends October 28, 1993. To be considered, mailed comments must be postmarked no later than October 28, 1993. Faxed comments cannot be accepted.

- Prior to the development of the Final Supplemental Environmental Impact Statement, comments received during the public comment period, July 30 to October 28, 1993, will be read and considered. Comments are most useful when they specifically address one or more of the following areas:
  - Inconsistent or unclear passages
  - New or corrected information
  - New or modified analyses of the effects
  - Another alternative that meets the underlying need

- Please send all comments to:

**Interagency SEIS Team**
**P.O. Box 3623**
**Portland, OR 97208-3623**

# 28876200

ID 880 34435

QL
696
.S83
D731
1993

# DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

## on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl

**Lead Agencies**

Forest Service
U.S. Department of Agriculture
Bureau of Land Management
U.S. Department of the Interior

**Cooperating Agencies**

Fish and Wildlife Service
National Park Service
U. S. Department of the Interior
National Marine Fisheries Service
U.S. Department of Commerce
U.S. Environmental Protection Agency

**Responsible Officials**

Mike Espy
*Secretary of Agriculture*

Bruce Babbitt
*Secretary of the Interior*

**For Further Information**

Robert T. Jacobs
*Interagency SEIS Team Leader*
P.O. Box 3623
Portland, Oregon 97208
(503) 326-7883

BLM LIBRARY
SC-653, BLDG. 50
DENVER FEDERAL CENTER
P. O. BOX 25047
DENVER, CO 80225-0047

# ABSTRACT

The Forest Service and the Bureau of Land Management propose to adopt coordinated ecosystem management direction for the lands they administer within the range of the northern spotted owl. This Supplemental Environmental Impact Statement (SEIS) presents as alternatives the options developed by the Forest Ecosystem Management Assessment Team and presented in their report Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. Each alternative identifies land allocations and management direction that provides for a range of protection of old-growth forests on lands administered by the Forest Service and Bureau of Land Management. The preferred alternative is Alternative 9. For the Forest Service, the SEIS will supplement the Forest Service *Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests* (January 1992). For the Bureau of Land Management, the SEIS will supplement the Draft Environmental Impact Statements for the Draft Resource Management Plans for the Coos Bay, Eugene, Medford, Roseburg, and Salem Districts, and the Klamath Falls Resource Area of the Lakeview District in Oregon; the King Range National Conservation Area Management Plan; the Final Environmental Impact Statements for the Resource Management Plans for the Arcata and Redding Resource Areas of the Ukiah District in California. The Record of Decision for this SEIS will supersede the management direction contained in existing Forest Service and Bureau of Landf Management plans for specific resources and areas that are identified in this SEIS.

# NOTICE

Readers should note that the Secretaries of Agriculture and the Interior are the responsible officials for this proposed action. This means that no administrative review ("appeal") through the Forest Service will be available on the Record of Decision under 36 CFR 217, nor will an administrative review ("protest") through the BLM be available on the Record of Decision under 43 CFR 1610.5-2.

To enable the Forest Service and Bureau of Land Management to fully analyze and use all information acquired during the review of this Draft SEIS, reviewers need to provide their comments during the established review period. Reviewers have an obligation to structure their participation so that it is meaningful and alerts the agency to their position and contentions (Vermont Yankee Nuclear Power Corp. v. NRDC, 435 US 519, 553 (1978)). Another court ruling established that environmental objections that could have been raised during the review of the Draft may be waived if they are not raised until after completion of the Final Environmental Impact Statement (Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980)).

Comments on this Draft SEIS should be as specific as possible, and address the adequacy of the statement or the merits of the alternatives discussed, or both.

# TABLE OF CONTENTS

**Summary** ........ S-1
Introduction ........ S-1
Background ........ S-1
The Proposed Action ........ S-1
The Issues ........ S-2
The Alternatives ........ S-4
The No-Action Alternative ........ S-4
The Action Alternatives ........ S-4
How the Alternatives are Structured ........ S-4
Land Allocations ........ S-4
Environmental Consequences ........ S-8
Comparison of the Effects of the Alternatives ........ S-8
Effects on Late-Successional and Old-Growth Forest Ecosystems ........ S-8
Effects on Aquatic Ecosystems ........ S-9
Effects on Threatened and Endangered Species ........ S-9
Effects on Species Not Threatened or Endangered ........ S-10
Effects on Timber Harvest Levels ........ S-15
Effects on Regional Economics and Communities ........ S-15

**Chapter 1 - Purpose and Need** ........ 1-1
Introduction ........ 1-1
Background ........ 1-1
The Underlying Need ........ 1-2
The Proposed Action ........ 1-2
The Purpose of the Proposed Action ........ 1-3
Scoping ........ 1-3

**Chapter 2 - The Alternatives** ........ 2-1
Introduction ........ 2-1
The Issues ........ 2-2
Consultation ........ 2-4
Critical Habitat ........ 2-4
The Planning Area ........ 2-4
Relationship of the SEIS Alternatives to Existing Forest Service and BLM Management Plans and Environmental Impact Statements ........ 2-6
Forest Service ........ 2-6
Bureau of Land Management ........ 2-7
Implementation ........ 2-7
Monitoring ........ 2-7
Adaptive Management ........ 2-7
Interagency Coordination ........ 2-8
The No-Action Alternative ........ 2-9
Introduction to the Action Alternatives ........ 2-12
How the Alternatives are Structured ........ 2-12
Elements from Previous Documents Incorporated into Alternatives by the Assesment Team ........ 2-14
Elements From the FEMAT Report Incorporated Into the Alternatives ........ 2-17

Comparison of Federal Land Allocation by Alternative ........ 2-19
The Alternatives ........ 2-20
    Alternative 1 ........ 2-22
    Alternative 2 ........ 2-24
    Alternative 3 ........ 2-26
    Alternative 4 ........ 2-30
    Alternative 5 ........ 2-32
    Alternative 6 ........ 2-34
    Alternative 7 ........ 2-36
    Alternative 8 ........ 2-38
    Alternative 9 the Preferred Alternative ........ 2-40
    Alternative 10 ........ 2-44
Alternatives Eliminated From Detailed Study ........ 2-46
Comparison of The Effects of the Alternatives ........ 2-48
    No-Action Alternative ........ v48
    Comparison of the Effects of the Alternatives ........ 2-49
    Effects on Late-Successional and Old-Growth Forest Ecosystems ........ 2-49

**Chapter 3&4 - Affected Enfvironment and Environmental Consequences** ........ 3&4-1
    Introduction ........ 3&4-1
    Relationship to the FEMAT Report ........ 3&4-2
    Incomplete or Unavailable Information ........ 3&4-2
    Cumulative Impacts ........ 3&4-2
Regional Introduction ........ 3&4-3
    Overall Land Ownership Patterns ........ 3&4-3
    Brief History of Resource Management in the Pacific Northwest ........ 3&4-4
    Description of Terrestrial Forest and Aquatic Ecosystems ........ 3&4-6
Terrestrial and Aquatic Ecosystems ........ 3&4-14
    Affected Environment ........ 3&4-14
    Environmental Consequences ........ 3&4-28
    Results of Assessment on Maintaining a Functional, Interconnected Late-Successional Forest Ecosystem ........ 3&4-41
    Threatened, Endangered and Proposed Species ........ 3&4-50
    Species not Threatened or Endangered ........ 3&4-63
    Three Court-Identified Defects to the Forest Service 1992 FEIS ........ 3&4-102
    The Economy and Communities ........ 3&4-105
    Other Environmental Effects ........ 3&4-139
    Adverse and Long-Term Consequences ........ 3&4-139

List of Preparers ........ 1
    Members of the Forest Ecosystem Management Assessment Team ........ 1
    Members of the Interdisciplinary Team ........ 1
    Special Acknowledgements ........ 5

Distribution List ........ 1
    Individuals ........ 9

Index ........ 1

Glossary ........................................................................................................................1

References ......................................................................................................................1

**Appendices**

Appendix A
Forest Ecosystem Management:
An Ecological, Economic, and Social Assessment ..............................Separate Volume
Appendix B - Additional Information on Standards and Guidelines ..................B-1
Revised Preferred Alternative .........................................................................B-2
Principles for Management ............................................................................B-39
Adaptive Management Areas .........................................................................B-57
Protection Buffers .............................................................................................B-67
Recovery Plan Standards and Guidelines ......................................................B-70
Aquatic Conservation Strategy ..................................................................B-B-75
Grants Pass Line. ..................................................................................................89
Appendix C - Letters of Direction ......................................................................C-1
Appendix D - Related Direction and Activities .................................................D-1
Appendix E - Report of the Agency Coordination ............................................E-1

## LIST OF TABLES

**Summary**

Table S-1 Summary and Comparison of Land Allocations and Standards and Guidelines Among Alternatives ........................................................ S - 6

*Table VI-16 Historic and Projected Employment in Timber Industries in the Next Decade by Subregion and Alternative ........................................................S - 18

**Chapter 2**

Table 2-1 Description of the No-Action Alternative ........................................2 - 10

Table 2-2 Summary and Comparison of Land Allocations and Standards and Guidelines Among Alternatives ..........................................................2 - 21

*Table III-1 Existing Options Considered with the FEMAT Ratings for the Five Biological Criteria ..........................................................................2 - 47

*Table VI-16 Historic and Projected Employment in Timber Industries in the Next Decade by Subregion and Alternative ......................................................2 - 59

**Chapter 3&4**

Table 3&4 - 1 Possible Outcomes for Maintenance of Abundance and Ecological Diversity ..................................................................................3&4 - 33

Table 3&4 - 2 Possible Outcomes for Maintenance of Ecological Processes and Function ........ 3&4 - 35

Table 3&4 - 3 Possible Outcomes for Maintenance of Connectivity ........ 3&4 - 36

Table 3&4 - 4 Acreages and Percentages of Forests Dominated by Conifers ........ 3&4 - 40

Table 3&4 - 5 Federally Listed Threatened, Endangered & Proposed Species ........ 3&4 - 52

*Table IV-1 Estimated Total Land Acreage Within the Range of the Northern Spotted Owl ........ 3&4 - 15

*Table IV-3 Current Estimated Late-Successional Conifer Forest ........ 3&4 - 17

*Table IV-4 Acres of Conifer Forest on Federal Lands ........ 3&4 - 18

*Table V-2 Summary of Road Development on Public Lands Within Range of the Northern Spotted Owl ........ 3&4 - 25

*Table IV-6 Criteria for Developing the List of Species ........ 3&4 - 30

*Table IV-13 Likelihood of Achieving Outcomes 1 & 2 ........ 3&4 - 44

*Table V-10 Fish Races/species/group Presented to Expert Panel ........ 3&4 - 98

*Table VI-2 Historic Harvest and Probable Annual Timber Sales by Alternative ........ 3&4 - 108

*Table VI-11 Predicted Decadal Average Timber Harvest Levels by Geographic Region ........ 3&4 - 111

*Table VI-12 First Decade Historic and Predicted Average Timber Harvests From Federal Lands ........ 3&4 - 112

*Table VI-13 Timber Industries and Total Employment by Subregion ........ 3&4 - 120

*Table VI-14 Average Timber Industries Employment by Subregion ........ 3&4 - 124

*Table VI-15 Historic and Projected Volume Processed by Subregion ........ 3&4 - 126

*Table VI-16 Historic and Projected Employment in Timber Industries in the Next Decade by Subregion and Alternative ........ 3&4 - 127

*Table VI-19 Historic Average and Projected Annual Federal Timber Receipts by Subregion ........ 3&4 - 129

*Table VII-7 Predicted Level of Consequences ........ 3&4 - 133

*Table VII-6 Relationship Between Community Capacity and Consequences ........ 3&4 - 134

**Appendix B**

Table B-1 Aquatic Habitat Quality Rating Scale ........ B - 12

Table B-2 Expected RMA Widths by Stream Order and Type ........ B - 13

Table B-3 BLM Revised Draft Preferred Alternative ........ B - 26

*Table V-12 Summary of Aquatic Conservation Strategy ........ B - 83

# LIST OF FIGURES

**Summary**

Figure S-1 Estimated Federal Land Allocation ........ S - 7

*Figure VI-2 First Decade Probable Timber Sale Levels (PSQ) for Alternatives and Historic Harvest Levels ........ S - 16

**Chapter 2**

Figure 2-1 Range of the Northern Spotted Owl Within the United States ........ 2 - 5

Figure 2-2 Allocation of Federal Lands by Alternative (Late-Successional Reserves calculated *after* Administratively Withdrawn Areas) ........ 2 - 19

Figure 2-3 Allocation of Federal Lands by Alternative (Late-Successional Reserves calculated *before* Administratively Withdrawn Areas) ........ 2 - 20

Figure 2-4 Alternative 1 ........ 2 - 23

Figure 2-5 Alternative 2 ........ 2 - 25

Figure 2-6 Alternative 3 ........ 2 - 29

Figure 2-7 Alternative 4 ........ 2 - 31

Figure 2-8 Alternative 5 ........ 2 - 33

Figure 2-9 Alternative 6 ........ 2 - 35

Figure 2-10 Alternative 7 ........ 2 - 37

Figure 2-11 Alternative 8 ........ 2 - 39

Figure 2-12 Alternative 9 ........ 2 - 43

Figure 2-13 Alternative 10 ........ 2 - 45

*Figure VI-2 First Decade Probable Timber S-ale Levels (PSQ) for Alternatives and Historic Harvest Levels ........ 2 - 57

**Chapter 3&4**

Figure 3&4 -1 Physiographic Provinces ........ 3&4 - 7

*Figure V-12 Riparian Forest Effects on Stream as Function of Buffer Width ........ 3&4 - 27

*Figure V-13 Riparian Buffer Effects on Microclimate ........ 3&4 - 27

*Figure IV-2 Projected Acreage of Late-Successional Forest ........ 3&4 - 41

*Figure IV-3 Likelihood of Achieving Outcomes ........ 3&4 - 43

*Figure V-26 Watershed Recovery ........ &4 - 48

*Figure II-8a Outcomes for Northern Spotted Owl and Marbled Murrelet ........ 3&4 - 59

*Figure IV-17 Northern Spotted Owl Confirmed Sites ........ 3&4 - 60

*Figure IV-8 Bryophytes ........ 3&4 - 64

*Figure IV-4 Common Fungi ........ 3&4 - 68

*Figure IV-5 Rare Fungi ........ 3&4 - 68

*Figure IV-6 Common Lichens ........ 3&4 - 70

*Figure IV-7 Rare Lichens ........ 3&4 - 70

*Figure IV-9 Vascular Plants ........ 3&4 - 74

*Figure IV-14 Arthropods ........ 3&4 - 79

*Figure IV-13 Mollusks ........ 3&4 - 82

*Figure IV-16 Amphibians ........ 3&4 - 86

*Figure IV-19 Birds ........ 3&4 - 88

*Figure IV-20 Mammals (except bats ........ 3&4 - 91

*Figure IV-21 Bats ........ 3&4 - 94

*Figure V-24 Assessment of Outcomes for Likelihood of Aquatic Habitat ........ 3&4 - 99

*Figure VI-2 First Decade Timber Sale Levels for Alternatives and Historic Harvest Levels ........ 3&4 - 109

*Figure VII-2 Predicted Consequences ........ 3&4 - 135

Appendix B

Figure B-1 BLM Revised Draft Preferred Alternative ........ B - 27

Figure B-2 Salem District Revised Preferred Alternative ........ B - 28

Figure B-3 Eugene District Revised Preferred Alternative ........ B - 30

Figure B-4 Coos Bay District Revised Preferred Alternative ........ B - 32

Figure B-5 Roseburg District Revised Preferred Alternative ........ B - 34

Figure B-6 Medford/Lakeview District Revised Preferred Alternative ........ B - 36

*Figure V-23 Context for Watershed Analysis ........ B - 81

*These figures also appear in Appendix A of this document.*

# Summary

## Introduction

This Draft Supplemental Environmental Impact Statement (Draft SEIS) presents 10 alternatives for managing old-growth and late-successional forests and discloses their environmental effects. The management direction applies only to the lands administered by the Forest Service and the Bureau of Land Management (BLM) of the Pacific Northwest and northern California within the range of the northern spotted owl. Alternative 9 is identified as the preferred alternative and presents information on the forest plan announced by President Clinton on July 1, 1993.

The purpose is to take an ecosystem approach to forest management; maintain and restore biological diversity as it applies to late-successional and old-growth forest ecosystems; maintain a sustained yield of renewable natural resources, including timber, other forest products, and other forest values; and maintain rural economies and communities.

## Background

An ongoing controversy concerning management of Federal lands has resulted in a gridlock of lawsuits, court rulings, appeals and protests. The public debate has expanded from a focus on management of northern spotted owl habitat to include all old-growth forest associated species and old-growth ecosystems.

Recent court rulings require completion of environmental impact statements. Both the Forest Service and the BLM are currently enjoined by the courts from selling timber in northern spotted owl habitat until they complete an EIS.

In order to seek a solution to the controversy, President Clinton held a Forest Conference in Portland, Oregon, on April 2, 1993. During the daylong conference, scientists, economists, representatives from the forest products industry and environmental groups, and others were invited to present concerns, opinions, or proposals to the President concerning the various issues surrounding the management of Federal lands in the Pacific Northwest and northern California.

After the Forest Conference, the Forest Ecosystem Management Assessment Team was assembled to prepare and assess alternative strategies that applied an ecosystem approach to forest management. This Draft SEIS presents the alternatives (options) developed by the Forest Ecosystem Management Assessment Team and discloses their environmental consequences.

## THE PROPOSED ACTION

The proposed action is to adopt coordinated management direction for the lands administered by the Forest Service and the Bureau of Land Management within the range of the northern spotted owl and to protect and enhance late-successional and old-growth forest ecosystems. The action amends the management direction established in all existing plans for the areas and resources covered by this SEIS.

This new management direction will apply to projects which will be conducted after site-specific environmental analysis. The existing management plans to be amended include existing Regional Guides, Forest Plans, Unit Plans, Timber Management Plans, Management Framework Plans, and Resource Management Plans for lands within the range of the northern spotted owl. The coordinated management direction established by the Record of Decision for this SEIS will also be incorporated into all land management plans within the range of the northern spotted owl as they are completed or revised.

## THE ISSUES

For over two decades there has been growing controversy over managing old-growth forests on Federal lands in the Pacific Northwest and northern California. When harvested, they have great economic value and make way for younger forests and the wildlife they support. If preserved, they provide an environment for many species and contribute to forest values and environmental qualities.

At the Forest Conference, President Clinton posed the fundamental question in his opening remarks:

> *How can we achieve a balanced and comprehensive policy that recognizes the importance of the forests and timber to the economy and jobs of this region, and how can we preserve our precious old-growth forests, which are part of our national heritage and that, once destroyed, can never be replaced?*

President Clinton continued:

> *The most important thing we can do is to admit, all of us to each other, that there are no simple or easy answers. This is not about choosing between jobs and the environment, but about recognizing the importance of both and recognizing that virtually everyone here and everyone in this region cares about both.*

This region's ecological systems are complex and varied. Managing these forest ecosystems to preserve and enhance late-successional and old-growth forests will have major effects on the overall structure, function, and appearance of the region's forests; the water quality in streams and rivers; and the distribution, connectivity, diversity, and sustainability of its terrestrial and aquatic communities.

In the last decade, the northern spotted owl became the focus in the debate over how Federal forest lands should be managed. The management of habitat for late-successional and old-growth related species affects other terrestrial and aquatic species and the region's ecological systems collectively. There are 42 federally-listed threatened or endangered species which may occur within the range of the northern spotted owl, including the spotted owl and the marbled murrelet. Nine of these listed species use Federal forested habitats. The long-term persistence of the spotted owl and other old-growth related species largely depends on adequate, well-distributed habitat for their life functions.

The set of factors affecting long-term persistence of these species, including the northern spotted owl, is complex and not precisely known. While most people want the spotted owl and other old-growth species to survive, there is disagreement over the size of populations that should be provided for, and the forest management that will ensure long-term survival.

Aquatic and riparian areas are integral parts of the region's ecosystems, and major factors in supporting the economy of the region. Damage to forest aquatic and riparian systems has contributed in part to degradation of some plant and animal communities. That degradation, combined with events downstream and at sea, have raised an immediate concern about the loss of salmon and steelhead runs, which are major cultural and economic elements in the Pacific Northwest and northern California. The concern is both for the numbers of fish and for their genetic diversity.

Since World War II, timber management has been a major part of the Forest Service and Bureau of Land Management's role of actively managing Federal lands for a variety of sustainable benefits for the Nation. The timber management program on Federal forests within the range of the northern spotted owl has focused on harvesting older forest areas for timber and replacing them with faster-growing young stands. Older forests are essential habitat for many species; as the amount of older forests decreased, the survival of old-growth related species, including the northern spotted owl, became more uncertain.

Managing Federal lands to provide habitat for northern spotted owls and other old-growth related species will result in a change in the extent and rate of harvest of older forest areas, as well as changes in how other forest areas are managed. Management to maintain or increase diversity of the forest's structure and function is itself an issue. Species that need young forests and species that need older forests are affected in different ways by changes in the age, composition, and distribution of the habitat they need.

The BLM and Forest Service's timber management programs provide raw material for the wood products industry that, after milling and processing, serves the needs of a variety of consumers. The wood products industry's principal employment is located in small cities, towns, and rural areas. From 1986 to 1990, wood from Federal forests supported half the industry's jobs. Additionally, a quarter of the receipts from timber sales on Federal lands (and half from "O&C lands") go to county governments.

Reductions in the amount of timber sold for harvest directly affect employment and the economic health of the forestry and wood products industries. These, in turn, affect the economic vitality of the communities dependent on them, and the well being of workers and families. These changes threaten the ability of some of these communities and their institutions to survive.

There are other human uses of Federal forest lands that will be enhanced, maintained or curtailed in managing habitat for the northern spotted owl and other late-successional and old-growth related species. Road construction and use, recreation, mining, and other land uses will be affected. There are alternate paths for people and communities to take to adjust to changes. The effectiveness of those paths is uncertain and the human costs of making those changes are significant.

# THE ALTERNATIVES

## The No-Action Alternative

The No-Action Alternative is essentially composed of the "No-Action" Alternatives in the EISs being supplemented by this SEIS. For both agencies, the No-Action Alternative basically represents the management direction that was in place before April 1990 when *A Conservation Strategy for the Northern Spotted Owl* ("the ISC Report" or "the Thomas Report") was released. Because of several court rulings and endangered species listings, it is clear that pre-April 1990 direction could not legally be implemented today.

## The Action Alternatives

The 10 action alternatives presented in this Draft SEIS are comprised of the 10 ecosystem management options developed by the Forest Ecosystem Management Assessment Team. The management direction applies to lands administered by the Forest Service and Bureau of Land Management within the range of the northern spotted owl. Each alternative assumes other Federal lands, such as those administered by the Fish and Wildlife Service, National Park Service, and Department of Defense, will be managed according to existing management plans and applicable Federal law.

## How the Alternatives are Structured

Like other recent strategies for management of northern spotted owl habitat or old-growth forests in the Pacific Northwest and northern California, the alternatives presented in this Draft SEIS propose a network of designated areas managed primarily to protect and enhance habitat for the northern spotted owl and other late-successional and old-growth forest related species, and nondesignated areas referred to as the "matrix". Within each of these areas, standards and guidelines set management direction and apply to management activities.

**LAND ALLOCATION CATEGORIES**

**Designated Areas**

- Congressionally Reserved
- Late-Successional Reserves
- Managed Late-Successional Areas
- Adaptive Management Areas
- Administratively Withdrawn Areas
- Riparian Reserves

**Matrix**

- Matrix

## Land Allocations

There are 24,260,700 acres of Federal land within the range of the northern spotted owl. Each of the alternatives in this Draft SEIS allocates these acres to one of the following six categories of designated areas, or to the matrix. These categories are:

### DESIGNATED AREAS

**Congressionally Reserved** - All alternatives retain land allocations for existing lands that are Congressionally reserved. These include designated Wilderness, Wild and Scenic Rivers, National Wildlife Refuges, National Parks, certain Research Natural Areas, and others. The location and size of these areas does not change among the alternatives. Management of these lands follows direction written in the applicable legislation or plans.

**Late-Successional Reserves** - Late-Successional Reserves are identified for each alternative. These areas would be managed to protect and enhance habitat for late-successional and old-growth related species including the northern spotted owl. For most alternatives, some level of silvicultural treatment (such as thinning young stands) is permitted in certain age stands in order to accelerate the development of old-growth habitat characteristics. These reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem.

**Managed Late-Successional Areas** - Managed Late-Successional Areas are identified for some alternatives in areas where regular and frequent fire was a natural part of the ecosystem. The objective within these areas is to produce and maintain an optimum level of late-successional and old-growth stands on a landscape scale. In these designated areas, certain silvicultural treatments and fire hazard reduction treatments are allowed in order to help prevent destroying the stands completely as a result of large catastrophic events such as fires, disease, or insect epidemics.

**Adaptive Management Areas** - Adaptive Management Areas occur only under Alternative 9. The objective for each of these areas is to learn more about ecosystem management while meeting social and economic objectives. Each area has a different emphasis to its prescription, such as maximizing the amount of late-successional forests or improving riparian conditions through silvicultural treatments.

**Administratively Withdrawn Areas** - Standards and guidelines of the current plans and draft plan preferred alternatives apply where they provide greater benefits to late-successional and old-growth related species than other provisions of these alternatives. Administratively Withdrawn Areas are those areas not scheduled for timber harvest and are not included in calculations of allowable sale quantity (ASQ). Administratively Withdrawn Areas include recreation areas, lands not technically suitable for timber production, certain visual retention and riparian areas, areas removed from timber production for the protection for local species, and others.

**Riparian Reserves** - The Riparian Reserves provide a buffer along all streams, wet areas, ponds, lakes, and unstable and potentially unstable areas. Riparian Reserves are not mapped, however insets of sample areas on the alternative maps in the map packet show sample distributions of riparian reserves.

## MATRIX

**Matrix** - The matrix consists of those Federal lands outside the six categories of designated areas listed above. Most timber harvest and other silvicultural activities would be conducted in the matrix, according to standards and guidelines. All **scheduled** timber harvest (i.e., that contributing to the ASQ) takes place in the matrix. Many of the alternatives apply the ISC Conservation Strategy's 50-11-40 rule for management of the matrix. Each alternative also specifies the amount of green trees, snags, and logs that will be left following management activities.

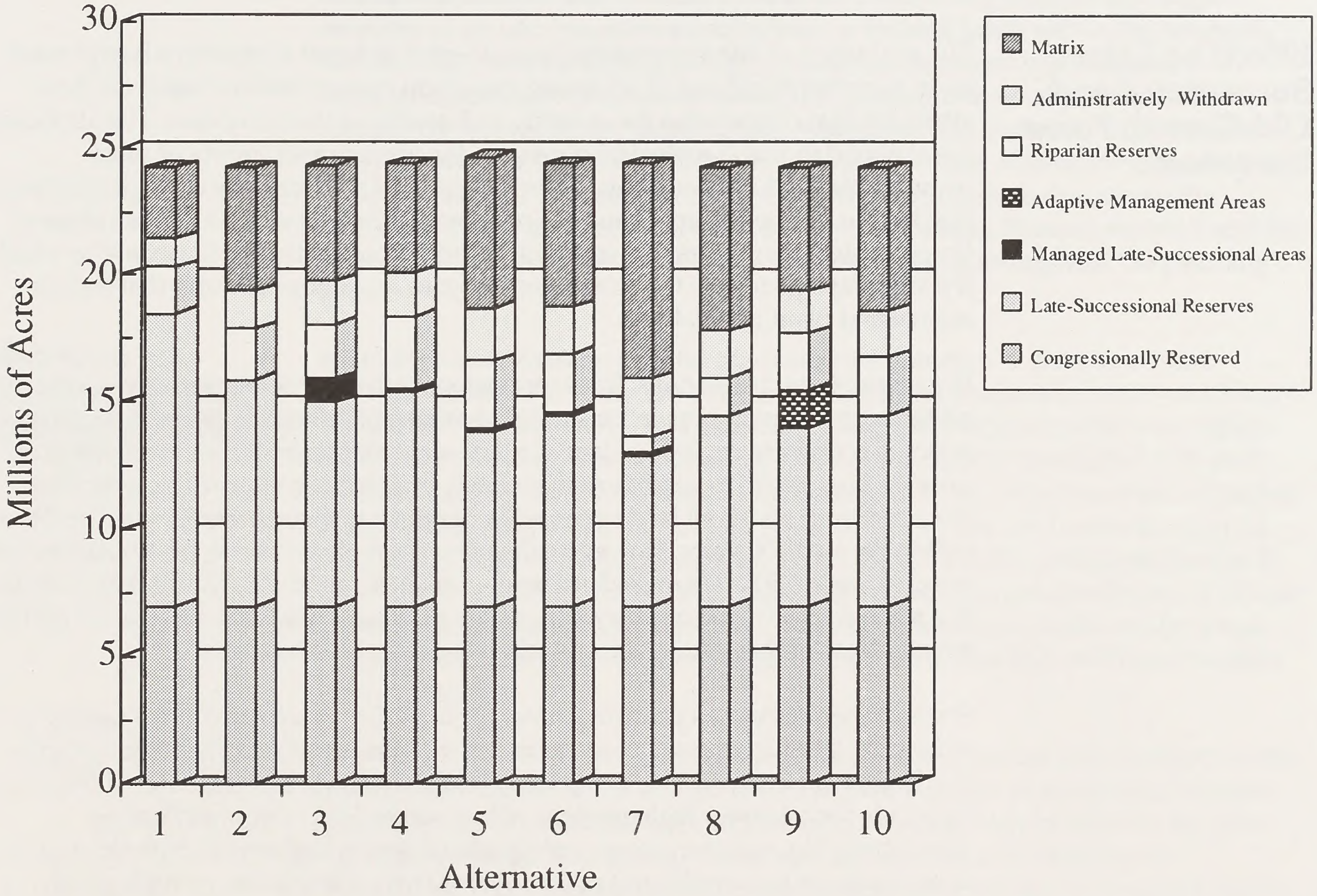
**Table S-1** Summary and comparison of land allocations and standards and guidelines among alternatives.

| | Alternative | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Congress. Reserve | million acres | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 |
| Late-Successional Reserves | million acres | 11.495 | 8.917 | 8.039 | 8.260 | 6.716 | 7.517 | 5.766 | 7.517 | 7.053 | 7.517 |
| | Timber harvest/salvage | None | Treatment of stands less than 50 years old. Very limited salvage | Same as Alternative 2 | Treatment of stands and salvage per Northern Spotted Owl Recovery Plan | Same as Alternative 4 | Same as Alternative 2 | Same as Alternative 4 | Treatment of stands in Murrelet Zone 1 up to 50 years. Other stands up to 180 years. | West - Treatment of less than 80 years old. East - Manage to reduce risk of catastrophic loss. | Same as Alternative 2 |
| | Protection for sites occupied by marbled murrelets outside reserves | Yes | Yes | Yes | Yes | Yes | Yes | No | No | Yes | Yes |
| | Protection of SAT species closely associated with old-growth | Yes | No | Yes | Yes | Yes | No | No | No | Yes | No |
| Managed Late-Successional Areas or Adaptive Management Areas (Alt. 9 only) | million acres | 0 | 0 | 0.846 | 0.147 | 0.147 | 0 | 0.147 | 0 | 1.488 | 0 |
| | Timber harvest/salvage | N/A | N/A | West-Long rotation, 50 percent retention East-Long rotation, or uneven-age management | Treatment of stands and salvage per Northern Spotted Owl Recovery Plan | Same as Alternative 4 | N/A | Same as Alternative 4 | N/A | Adaptive Management Areas (See Appendix B) | N/A |
| Administrative Withdrawn Areas | million acres | 1.081 | 1.517 | 1.685 | 1.660 | 2.078 | 1.834 | 2.286 | 1.834 | 1.653 | 1.834 |
| Riparian Reserves | million acres | 1.870 | 1.993 | 2.120 | 2.881 | 2.651 | 2.288 | 0.619 | 1.495 | 2.231 | 2.288 |
| | Buffer widths[1] | 2:1:1 | 2:1:1 in Aquatic conservation emphasis key watersheds, 2:1:$^1/_2$ other watersheds | Same as Alternative 2 | Same as Alternative 1 | Same as Alternative 2 | Same as Alternative 2 | Variable, usually no buffers on intermittent streams | 2:$^1/_2$:$^1/_4$ | Same as Alternative 2 | Same as Alternative 2 |
| Matrix | million acres | 2.831 | 4.851 | 4.587 | 4.330 | 5.686 | 5.638 | 8.460 | 6.431 | 4.853 | 5.638 |
| | 50-11-40 | Yes | Yes | Yes | Yes | Yes | Yes | Natl. Forest- Yes<br>BLM-modified | No | No | No |
| | Snags; Logs; Green trees per acre | 2:2:6 | 2:2:6 | Support 40% pop: West - 12, East 2-10:4 | Variable on National Forests. BLM-2:2:6-9 | Same as Alternative 4 | 2:2:6 | Same as Alternative 4 | Same as Alternative 4 | Coastal areas WA/OR: 2:2:0 Other areas retention or long rotation. | 2:2:6 |

---

[1] Riparian Reserve Buffer Widths (e.g. 2:1:1), are expressed as multiples of the height of a maximum site-potential tree, measured on each side of fish bearing stream, non-fish bearing streams, and intermittent streams respectively (see text).

**Figure S-1 Estimated Federal Land Allocation by Alternative**



# ENVIRONMENTAL CONSEQUENCES

## Comparison of the Effects of the Alternatives

Chapter 3&4 describes in detail the environmental consequences of the alternatives. Under each of the alternatives considered, timber harvests of older forests will decline from historic levels. The environmental consequences associated with timber harvest, such as loss of late-successional forest habitat, new road construction, increased stream sedimentation, and water quality degradation, will be proportionately less. Social and economic impacts to timber-dependent communities will be proportionately greater. The preservation of late-successional and old-growth forests will have beneficial consequences to the wildlife and plants associated with them, to water quality and to ecological diversity. The following discussion summarizes and compares the key impacts identified.

## Effects on Late-Successional and Old-Growth Forest Ecosystems

The evaluation of late-successional and old-growth forest ecosystems is expressed as an expected likelihood of achieving long-term past conditions based on three attributes that characterize the quantity and quality of the ecosystem. The attributes are a) abundance and ecological diversity - the acreage and variety of plant communities and environments, b) processes and functions - the ecological actions that lead to the development and maintenance of the ecosystem and the values of the ecosystem for species and populations, and c) connectivity - the extent to which the landscape pattern of the ecosystem provides for biological flows that sustain animal and plant populations.

In general, forest plantations, fire suppression, high rates of logging, ownership patterns, and human population and environmental influences have altered the regional ecosystem on Federal lands to the extent that none of the alternatives can provide for a return to conditions that closely match those of previous centuries. Site conditions across all landscapes will not return to their presettlement conditions within the next 100 years. However, all of the alternatives reverse the management trend of the last 50 years on Federal lands, which, if continued, would have resulted in a steep decline in the quantity and quality of late-successional ecosystems and the eventual loss of these ecosystems in many Federal planning areas.

Some of the alternatives provide greater likelihoods than others of maintaining and enhancing late-successional ecosystems at levels that approach typical long-term conditions. Alternatives 1, 3, 4, and 9 received the highest ratings. Alternatives 3 and 4 provide for relatively high amounts of late-successional forest and strong connectivity through the presence of riparian reserves and retention of old-growth components in managed forest matrix. Alternatives 3 and 4 also provide relatively high acreage of low elevation late-successional ecosystems, which are relatively rare throughout the entire region. Although Alternative 1 provides for the highest acreage of Late-Successional Reserves, it did not rate as high as Alternatives 3 and 4 because it lacks restoration silviculture in the reserves.

The Assessment Team assumed that without restoration silviculture, the development of late-successional conditions would be retarded. Alternative 9 achieved a 60 to 80 percent or greater cumulative likelihood of reaching less than long-term average conditions or better in moist provinces. Alternative 9 might have achieved a higher overall rating if it provided for more acreage of late-successional ecosystems in the low elevations of Oregon. The Assessment Team concluded that the opportunities to increase knowledge about ecosystem function and management in the Adaptive Management Areas of Alternative 9 actually increased the likelihood that this alternative would provide late-successional characteristics in the future.

## Effects on Aquatic Ecosystems

The Aquatic Conservation Strategy (Appendix B) was designed to incorporate all elements of the aquatic and riparian ecosystem, including maintenance of hydrologic function, high water quality, adequate amounts of large woody material, a stable, complex stream channel, and a riparian area with suitable microclimate and vegetation. The likelihood of achieving an outcome with sufficient quality, distribution and abundance of habitat to allow plant and animal species to stabilize, well-distributed across Federal lands, is lower for Alternatives 2, 3, 5, 6, 9, and 10 than for Alternatives 1 and 4. However, the Assessment Team determined that all alternatives except 7 and 8 would reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on Federal lands within the range of the northern spotted owl. Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no alternative will completely recover all degraded aquatic systems within the next 100 years. Faster recovery rates are probable for aquatic ecosystems under Alternatives 1 and 4 than other alternatives. Alternatives 1 and 4 would reduce disturbance across the landscape due to application of a larger Late-Successional Reserve network and the use of wider Riparian Reserves for intermittent streams throughout the planning area.

## Effects on Threatened and Endangered Species

All of the alternatives provide for the continued existence of threatened and endangered species. There are 42 federally listed and proposed species which may occur in the planning area. This includes those species whose habitat associations are known to include late-successional forest or are directly associated with such habitat. A portion of the listed and proposed species were eliminated from detailed discussion in this SEIS for one of four reasons: 1) they are not known to occur on the Federal lands of the planning area, 2) they do not inhabit coniferous forests, 3) their use of coniferous forests is not dependent on old-growth conditions, or 4) their presence in the northern spotted owl's range is transitory or unaffected by forest management activities. The alternatives considered in this SEIS will have no effect on these species.

The Fish and Wildlife Service identified those "species that are not restricted to only late-successional forests or that are associated with unique or specialized habitats that may not be considered late successional, but which may be affected by forest management activities." Some of these species were not evaluated by the Assessment Team because of their lack of association with late-successional forests, however, they are addressed in this SEIS to provide a complete accounting. The alternatives in this SEIS are not likely to adversely affect these species.

Three listed or proposed species are associated with late-successional forests: the bald eagle, the northern spotted owl, and the marbled murrelet. None of the alternatives is likely to adversely affect the bald eagle. The following discussion summarizes the effects of the alternatives on the other two species.

**Northern Spotted Owl.** The effectiveness of an alternative in providing for northern spotted owl recovery on Federal lands relies heavily on the spacing, size and location of the habitat. It was the conclusion of the Assessment Team that

Alternatives 1 through 6 and 9 met or exceeded the conservation measures for Federal lands for the *Final Draft of the Northern Spotted Owl Recovery Plan* (USDA 1992a). Alternatives 7, 8 and 10 were found to have less assurance of owl recovery on Federal lands. However, based on the protection of sites in reserves, and matrix management provisions, all of the alternatives are likely to be compatible with recovery of the northern spotted owl. The range of protection for known northern spotted owl sites in the short term (next fifty years) is from 55 percent of owl sites protected under Alternative 7, to 89 percent of sites in Alternative 1. These estimates are for owl sites protected in Late-Successional Reserves, Managed Late-Successional Areas and Adaptive Management Areas only. It is unknown at this time how many additional northern spotted owl sites would be protected from timber harvest as a result of their location in Riparian Reserves within the matrix.

**Marbled Murrelet.** In the short term, the alternatives will provide a varying degree of "reserve" protection for the population of murrelets known to occur in the planning area. However, eight alternatives (all but Alternatives 7 and 8) provide for protection of murrelet sites outside of the reserves. The full impact of this protection outside reserves is not known at this time because of the limited surveys conducted for this species. Over the long term, most of the alternatives would eventually produce substantially more suitable habitat for marbled murrelets than currently exists, and that habitat would be in larger blocks (which is preferable for this species). These results are based, in large part, on the fact that Alternatives 1 through 6 and 10 meet or exceed the recommendations of the murrelet working team. Because Alternatives 7 and 8 did not include the recommendations, they are considered far less protective of murrelets and less compatible with expected marbled murrelet recovery efforts. Alternative 9 includes a modification of the working team's recommendations, so is better than Alternatives 7 and 8, but not as good as Alternatives 1 through 6 and 10.

## Effects on Species Not Threatened or Endangered

The Assessment Team determined that 1,084 terrestrial species were closely associated with late-successional and old-growth forests. These species were grouped into bryophytes, fungi, lichens, vascular plants, mollusks, amphibians and reptiles, birds, and mammals. A list of 15 functional groups of arthropods was also considered. Twenty-nine species of fish were determined to occur in streams within late-successional and old-growth forests. Each of the alternatives were evaluated to determine the likelihood of habitat on Federal lands to support populations of these species or groups of species. Expert panels were asked to predict a percent likelihood whether habitat would be of sufficient quality, distribution and abundance for species populations to a) stabilize, well distributed, b) stabilize with significant gaps in distribution, c) continue existence only on refugia, or d) be at risk of extirpation. The assessment process and the potential outcomes that were predicted are described for each of the species or groups of species in Chapter 3&4 and are summarized below.

**Bryophytes**. In general, those alternatives that retain habitat features important to bryophytes associated with late-successional and old-growth forests resulted in higher outcomes. Alternatives 1, 3, 4, 5, and 9 consistently rated higher than Alternatives 7 and 8 for most bryophytes. The riparian prescriptions in all alternatives except 7 and 8 influenced the ratings to be near an 80 percent or greater cumulative likelihood of providing habitat sufficient to allow the species population to stabilize, well distributed for the majority of the bryophyte groups. However, riparian buffer widths were often inadequate to protect the bryophytes that occur in the floodplains. Four extremely rare species have a likelihood of achieving habitat sufficient to allow the species population to stabilize, but with significant gaps in the historic species distribution. The ratings for these four species do not vary by alternative and are not primarily reflective of alternative design. Under all alternatives these four species would need site specific surveys, analyses and site protection.

**Fungi.** Projected future likelihoods of maintaining habitat for fungi corresponded with the acreage of Late-Successional Reserves and management in the matrix. Ratings for the groups of fungi varied considerably across the different alternatives. Fungi were rated lower for alternatives that had less acreage of Late-Successional Reserves, fewer old-growth patches, and less large woody debris and green tree retention in the matrix. Most of the common fungi had potential outcomes for well-distributed habitat, or well distributed but with significant gaps. For Alternative 1, 92 percent of the common fungi groups rated 80 percent likelihood of having habitat sufficient to allow the species population to stabilize, well distributed, and 72 percent of the groups received this rating for Alternative 3. Alternatives 4, 5, and 9 had lower ratings with 16 to 20 percent of the fungi groups rating an 80 percent likelihood of a stabilized, well-distributed population; 8 percent received this rating for Alternatives 7 and 8.

Rare or uncommon fungi totaled 146 species, or 28 percent of the fungi evaluated and represent the species of greatest concern. The rare and locally endemic species were generally rated with an 80 percent likelihood of populations being restricted to refugia which reflects their current distribution. There was, however, a spread of uncertainty for populations achieving some level of well distributed with gaps or a risk of extirpation. For many of these species, there was little difference in ratings across the alternatives. This reflects the relatively random chance that a population will actually occur within a given reserve.

**Lichens.** Outcome ratings were generally highest for Alternatives 1, 3, and 4; intermediate under Alternatives 5 and 9; and lowest under Alternatives 7 and 8. Outcome ratings for lichens were generally correlated with the acreage of Late-Successional Reserves, stand treatments within the matrix, and protection for riparian corridors (aquatic and riparian lichens). Rare lichens rated much lower than common lichens because some of the rare lichen species have narrow geographic ranges and only occur in specialized habitats. Under Alternative 9, there are three species groups for which the 80 percent cumulative likelihood included risk of extirpation. However, these three groups could not rate higher than being restricted to refugia under any of the alternatives due to their narrow geographic range and occupancy of specialized habitats. Seven species groups have 80 percent cumulative likelihoods of being restricted to refugia or better under Alternative 9. Three of these groups are rare; two are associated with aquatic and riparian areas (which receive less protection under Alternative 9 than under Alternatives 1 and 4); and two are closely associated with late-successional and old-growth forests (which receive greater protection under Alternative 1 than 9).

**Vascular Plants.** A total of 110 vascular plants (84 percent) received a greater than 80 percent likelihood of achieving well-distributed habitat sufficient to allow populations to stabilize in Alternative 1. The overall ratings of Alternatives 3, 4, and

5 were similar to each other, but lower than Alternative 1. Alternative 9 tended to have lower probabilities of achieving well-distributed habitat than Alternatives 3, 4, and 5, but were higher for most species than Alternatives 7 and 8. Alternatives 7 and 8 consistently received the lowest ratings. Ratings tended to be lowest for rare species that were geographically restricted or sparsely distributed throughout a larger range. Two species were considered to have a risk of extirpation within portions of their range under Alternative 1, while three species were considered to have a greater than 40 percent cumulative likelihood of extirpation under Alternative 7. In Alternative 1, 22 species had less than 80 percent likelihood of achieving well-distributed habitat. Five of these species are endemics, three are on the periphery of their range, and thirteen are rare or uncommon. In Alternative 7, 53 species had less than an 80 percent likelihood of achieving well-distributed habitat. Under Alternative 9, 39 species had less than an 80 percent likelihood of achieving well-distributed habitat.

In addition to the 22 species that received a similar outcome in Alternative 1, two commercially important conifers were included in this category for Alternative 7. Pacific yew and Port-Orford-cedar would have less than an 80 percent likelihood of being well-distributed throughout their range under Alternative 7. Pacific yew in the Klamath/Siskiyou Physiographic Province and Port-Orford-cedar throughout its range are included in this category. Both species received higher ratings in Alternative 1 than in any other alternative due to the protection of the smaller late-successional and old-growth fragments that are important to these species.

**Arthropods.** For most functional groups, Alternatives 1 and 3 provide the greatest likelihood that arthropod function will be maintained across Federal lands. Twelve and nine of the 15 groups or ranges, respectively, were given an 80 percent likelihood for well-distributed populations under these alternatives. Alternatives 4, 5, and 9 provide for a lower likelihood with six, five, and five groups, respectively, reaching an 80 percent likelihood of being well-distributed. Alternatives 7 and 8 provide for only minimal likelihood that arthropod function would be maintained, with three and two groups, respectively, receiving an 80 percent likelihood for well-distributed populations.

**Mollusks.** Only Alternative 1 provides habitat to maintain any of the mollusk species well-distributed across Federal lands with a likelihood of 80 percent or better. Assessments for Alternatives 3, 4, 5, 7, 8 and 9 indicate that a large number of species will have substantial probabilities of being restricted to refugia or a risk of extirpation. Differences among the alternatives were based primarily on the total acres proposed for reserves, the locations of specific reserves, and the management proposed within reserves; and on the proposed forms of watershed protection (for freshwater snails and clams). Alternatives 1 and 4 contain full riparian protection measures and analysis shows that the freshwater species would fare better under these alternatives. High degrees of endemism and rareness account, in part, for the low ratings assigned the mollusks. Many of the mollusk species are endemic to only one area or river drainage, and their dispersal capability is low. Under Alternative 9, there were 20 mollusk species for which the 80 percent cumulative likelihood included risk of extirpation.

**Amphibians and Reptiles.** Ratings for individual species were highly variable among alternatives. Because of the preponderance of riparian-associated species, overall results of the analysis reflected the level of riparian buffer protection along headwater and intermittent streams in each alternative. Alternatives 1 and 4, which included the widest buffer widths on all intermittent streams and seeps, had the greatest number of species with high likelihoods of having well-distributed, stable populations over the next 100 years. Overall ratings for Alternatives 3, 5, and 9 were very similar, again reflecting their similar riparian standards. Alternatives 7 and 8 had much lower overall ratings. No species had a high likelihood for a stable, well-distributed population under Alternative 7 and only one species had such a likelihood under Alternative 8. Eleven of the 19 species or subpopulations occur as endemics, restricted through habitat specialization and geographic subtleties to small, isolated populations. These small populations are at risk to local extirpation through either land management activity or catastrophic habitat modification due to natural events. Three species had an 80 percent likelihood of being restricted to refugia or extirpation for all of the alternatives. Ratings for these species should not be considered a function of the management of Federal lands. Under Alternative 1, there is an 80 percent or greater likelihood that distribution for 16 species would be well-distributed or have gaps. Of these, 14 were well distributed. In contrast, Alternatives 3, 4, 5 and 9 provide habitat conditions for 16 species resulting in an 80 percent likelihood of being well distributed or having gaps, but only half of these species were most likely to be well distributed. For Alternatives 7 and 8, five species were rated as achieving an 80 percent cumulative likelihood of being restricted to refugia or better and three for which the 80 percent cumulative likelihood included risk of extirpation.

**Birds.** Ratings for individual species were similar among alternatives. Alternatives 1, 3, 4, and 5 provided habitat to maintain all 36 bird species well distributed with a likelihood of 80 percent or better. For Alternatives 7 and 9, the Assessment Team concluded that 35 species had an 80 percent or greater likelihood of having a well-distributed population. In Alternative 8, seven species were rated as having less than an 80 percent likelihood of having a well-distributed population, and one species was rated as having less than a 60 percent likelihood of being well distributed. For 19 of the 36 bird species, all 7 alternatives were rated as providing a 100 percent likelihood of maintaining a well-distributed population. Of those that did not rate 100 percent likelihood, most need further study to address habitat needs. In addition, the ranges of a number of species only slightly overlap the range of the northern spotted owl. Alternative 7, which included narrow riparian buffers, rated lower for a number of waterfowl that nest adjacent to streams or lakes. Alternative 8, which allowed considerable salvage and harvest within reserves, rated lower than most other alternatives for a number of woodpeckers and other cavity nesters that depend upon large snags. Alternatives 7 and 8 also rated lower for a number of species because neither alternative included the mitigation measures identified in other alternatives for selected species thought to be at risk under the existing agency plans.

**Mammals.** For mammals other than bats, the alternatives were generally rated as having above an 80 percent likelihood of providing habitat sufficient to allow a stabilized, well-distributed population except for red tree voles, martens, and fishers. In general, those alternatives that provided for greater amounts of late-successional and old-growth habitat resulted in higher likelihoods of producing this outcome. Alternatives 1, 3, 4, and 5 were rated as providing greater than an 80 percent likelihood of achieving a well-distributed population for both species of red tree voles. Ratings were progressively lower for Alternatives 9, 8 and 7, respectively, where the likelihood ranged from 78 down to 58 percent. American martens were rated for the entirety of their range within the range of the northern spotted owl. They were rated as having a greater than 80 percent likelihood of achieving a stabilized, well-distributed population under Alternative 1. Alternatives 3 and 4 were rated 73 to 77 percent for this outcome. Ratings for Alternatives 5, 8, and 9 were lower with approximately 67 percent likelihood of achieving this outcome. Alternative 7 rated lowest, with less than a 60 percent likelihood of achieving a stabilized, well-distributed population. Ratings for the fisher were similar to those for martens. Ratings for percent likelihood of achieving a well-distributed population for Alternatives 1, 3, 4, 5, 7, 8 and 9 were, respectively, 85, 82, 73, 70, 67, 63, and 63. Ratings for fisher reflected a general uncertainty about the future welfare of this species regardless of the alternative. All alternatives rated above a cumulative 80 percent likelihood, for all species examined, of providing habitat sufficient to allow the species population to stabilize, but with significant gaps in distribution.

For bats, the different alternatives varied in their likelihoods of providing sufficient and well-distributed habitat to ensure persistence. Alternatives 1 and 3 were rated highest, and Alternatives 7 and 8 rated lowest. All species rated more than 80 percent likelihood for well-distributed populations under Alternatives 1 and 3. For Alternative 4, eight species rated more than an 80 percent likelihood for this outcome. Under Alternative 5, four species rated more than an 80 percent likelihood for well-distributed populations, and seven species rated 65 to 73 percent. For Alternative 9, four species rated more than 80 percent for this outcome, two species rated 60 to 70 percent, and five species rated 45 to 55 percent. No species rated more than 80 percent for achieving a well-distributed population under Alternatives 7 or 8, and seven species rated less than 60 percent under each of these alternatives.

**Aquatic Species.** Alternatives 1 and 4 had the highest likelihood of attaining habitat to allow fish species to stabilize well distributed; the likelihood was 80 percent or higher for all races/species/groups. The relatively high likelihood for these alternatives was because of the large amount of area in reserves and the riparian strategy on all federal lands within the range of the spotted owl proposed for these alternatives. Alternatives 2, 3, 5, 6, 9, and 10 generally had a 60 to 70 percent likelihood of attaining habitat to allow widely-distributed races/species/groups. Alternatives 7 and 8 had the lowest likelihoods of attaining habitat to allow stabilized, well-distributed races/species/groups. The likelihood of attaining this habitat for Alternative 7 was from 10 to 15 percent, the exception being bull trout, which was 35 percent. Alternative 7 was ranked low primarily because of the low amount of riparian areas and the amount of activity that was allowed within them in agency land management plans.

Likelihoods of attaining well-distributed races/species/groups were slightly higher for Alternative 8 than for Alternative 7 but were less than for the other alternatives. Likelihoods of attaining this habitat ranged from 20-25 percent for all groups except bull trout, which was 45 percent, in Alternative 8. Alternative 8 has a lower likelihood of attaining habitat to allow well-distributed races/species/groups than did alternatives other than 7 because of the reduced size of Riparian Reserves, particularly for intermittent streams.

## Effects on Timber Harvest Levels

Estimates according to the BLM and Forest Service indicate that timber sales planned in Federal forests in the range of the northern spotted owl under the No-Action Alternative would have been 3 to 4 billion board feet per year in the 1990's, generating more that $1 billion annually in economic benefits in the Pacific Northwest. Annual harvest levels from Federal forests had averaged 5.6 billion board feet during the period 1980 to 1989. The alternatives considered to protect the habitat of the northern spotted owl and associated late-successional species will restrict timber harvest in these forests, resulting in substantial social and economic costs.

The probable levels of Federal timber sales for the first decade for each alternative are summarized in Figure VI-2, First Decade Probable Timber Sale Levels (PSQ) for Alternatives and Historic Harvest Levels. Figure VI-2 includes "other wood" which is the volume of cull, salvage, and other products that is not normally part of allowable sale quantity calculations. Historically, this has accounted for about 10 percent of the total harvest volume from Federal lands in the planning area. Sale levels in subsequent decades do not increase to any notable extent.

Estimated sale levels under all alternatives are below program levels of the 1980's, as well as below the harvest levels of 1990-1992. Almost all new Federal timber sales in the planning area have been enjoined. In 1990-1992, harvest consisted of sales under contract from the 1980's. The allocations and the standards and guidelines of the alternatives will not permit 1990-1992 levels of timber harvest in the future. In the next 1 to 3 years, the outlook for sale levels is substantially less than the average sales potential for the decade.

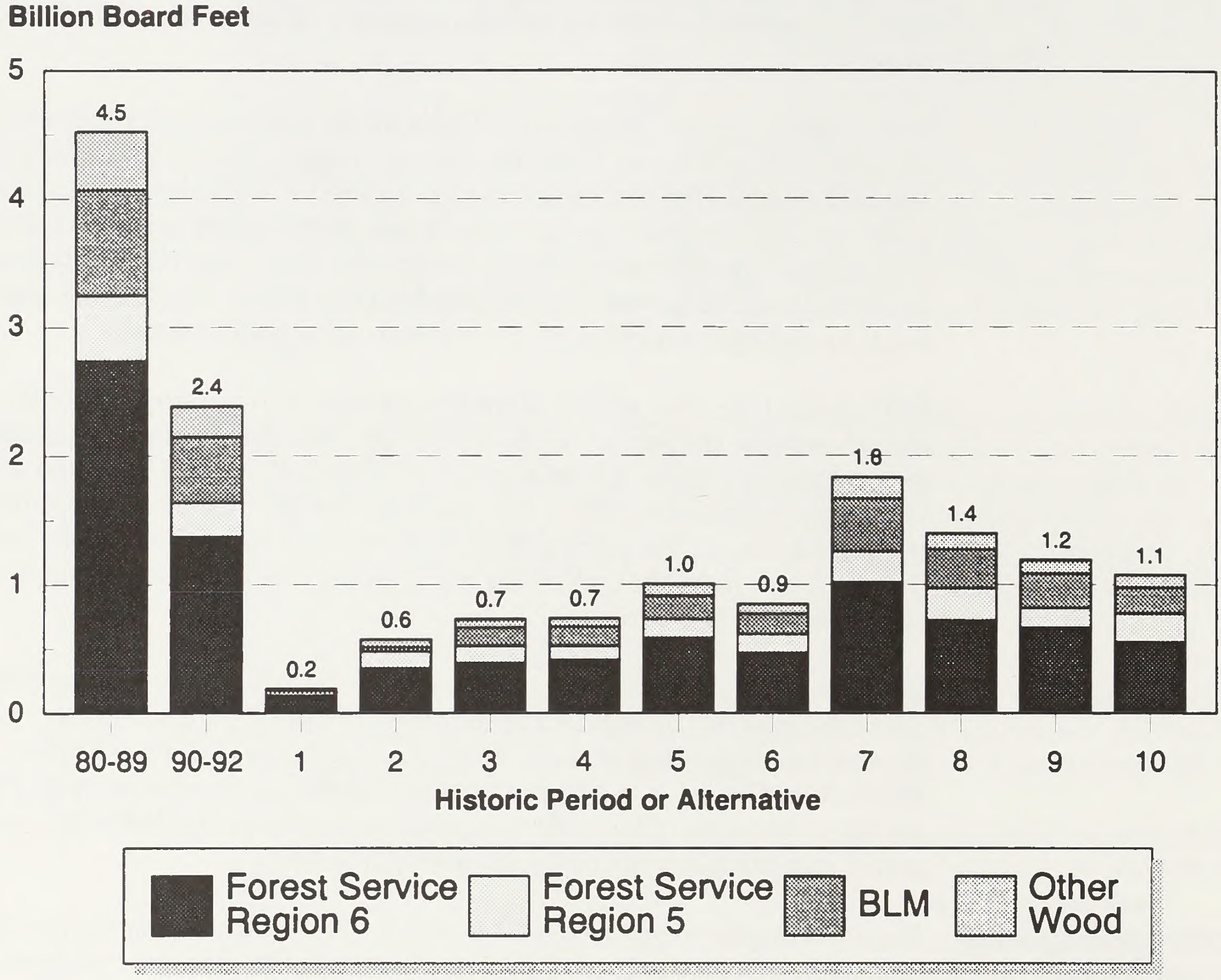
In addition to reduced harvest quantities in the decade ahead, wood quality is also apt to decrease. In the first decade, thinnings and other partial harvests would account for a large proportion of the volume harvested under the various alternatives. Secondary wood products manufacturers may see an even greater decline in the amount and quality of wood stock than the probable sale quantities would indicate as a result of smaller average log size.

## Effects on Regional Economics and Communities

**Regional Employment.** Under all of the alternatives, direct employment in timber harvesting and processing will decline as a result of reduced harvest levels as shown in Table VI-16, Historic and Projected Employment in Timber Industries in the Next Decade by Sub-Region and Alternative. Projections imply a range of job displacement from 1,700 to 12,500 jobs relative to 1992. However, compared to 1990 employment levels, these projections predict displacement of 21,200 to 32,000 jobs. The majority of the jobs affected are located in Oregon, and are concentrated in southwestern Oregon.

The alternatives presented in this Draft SEIS would have the greatest effect on the timber industry sector. In addition to the workers displaced, there would be "indirect effects" caused by fluctuating business expenditures in the region and "induced effects" caused by changes in personal expenditures in the region. These ripple effects tend to increase the ramifications of job gains or losses in communities or regions. There is roughly one job lost outside the timber industry for every job affected within the timber industry. The subregions that are characterized as heavily

**Figure VI-2.** First decade probable timber sale levels (PSQ) for alternatives and historic harvest levels.



timber- dependent are apt to see the most severe impacts. While service employment in forestry appears to also be faced with job declines, these could be offset through investments in reforestation, inventory, and restoration activities. Some employment gains could be made in recreation and tourism, as well as in special forest products. It may, however, be difficult to absorb displaced loggers and mill workers into these fields due to skill considerations and geographic locations. In the long run, the alternatives may provide an increased supply to commercial fisheries, but in light of the current issues and the potential over-capacity of the industry, these gains may not be substantial. Rehabilitation of salmon and trout runs, however, could have positive effects on the coastal recreation fishery.

While the net impact of implementation of any of the alternatives is apt to displace natural resource-based jobs, the economy of the region as a whole is predicted to continue to grow. Rural communities will lose jobs and decline while the more developed areas continue to expand.

**Rural Communities.** Washington, Oregon, and California differ in the pattern, severity, and regional distribution of the effects of reduced timber harvest to communities. The results of the analyses are discussed in terms of the severity and direction of the consequences, the communities' capacity to cope, and the resultant risk to the communities. The Assessment Team conducted a detailed analysis of Alternatives 1, 3, and 7. It found relatively few differences among the effects of the alternatives because the timber harvest levels in Alternatives 1 through 10 are far below recent averages. Impacts associated with Alternative 9 would likely fall between those presented for Alternatives 3 and 7.

Communities with combinations of low capacity to cope with change and negative consequences from the alternatives are "most at risk"; those with high capacity to cope and positive consequences are "least at risk." Using these definitions, Alternatives 1, 3, and 7 would result in about one-third of the 167 surveyed communities falling in the "most at risk" category. In all three alternatives, however, the changes are great compared to those for the 1985-87 harvest level scenario in which only 3 percent of the communities were so ranked. The majority of the communities "most at risk" in Alternatives 1, 3, and 7 are those highly dependent on the timber industry and on Federal forest lands as the source for much of their timber supply. Alternatives 1, 3, and 7 would likely lead to additional mill closures and reduced forest related employment, and to real damage to the economic and social infrastructure.

The "most at risk" communities differ from others in significant ways. These communities are smaller (average population 3,000), and they are located in counties with low population density. Isolated communities are more likely to experience negative consequences with Alternatives 1, 3, and to a lesser degree 7, because they have few options available locally or in nearby communities, and because of limited access to capital, transportation links, and other resources. Communities that are small, isolated, and lacking economic diversity are more likely to be "at risk" than others. These communities may find it difficult to mobilize and respond to changing conditions which may affect a variety of groups. These communities are likely to experience unemployment, increased poverty, and social disruption in the absence of assistance.

**Table VI-16.** Historic and projected employment in timber industries in next decade, by subregion in the study area and alternative.[1]

|  | Actual | Estimated | Alternative |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State/Region | 1990 | 1992 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  |  |  | ----------thousand jobs--------------- |  |  |  |  |  |  |  |  |  |
| Washington - |  |  |  |  |  |  |  |  |  |  |  |  |
| Olympic Peninsula | 13.9 |  | 12.0 | 12.1 | 12.1 | 12.0 | 12.1 | 12.0 | 12.0 | 12.0 | 12.1 | 12.0 |
| Puget Sound | 25.7 |  | 20.9 | 21.0 | 21.0 | 21.0 | 20.9 | 21.0 | 20.9 | 21.1 | 21.0 | 21.0 |
| Lower Columbia | 14.1 |  | 12.7 | 12.8 | 12.8 | 12.8 | 12. | 12.8 | 12.9 | 12.9 | 12.9 | 12.8 |
| Central | 4.2 |  | 4.0 | 4.2 | 4.3 | 4.2 | 4.3 | 4.3 | 4.4 | 4.5 | 4.3 | 4.4 |
| *Total* | *57.9* | *51.3* | *49.7* | *50.1* | *50.1* | *50.0* | *50.2* | *50.1* | *50.3* | *50.5* | *50.2* | *50.2* |
| Oregon - |  |  |  |  |  |  |  |  |  |  |  |  |
| Northwest | 21.9 |  | 20.4 | 20.8 | 20.9 | 21.0 | 21.3 | 21.0 | 22.3 | 21.4 | 21.3 | 21.1 |
| West-Central | 20.9 |  | 14.3 | 14.8 | 14.9 | 15.0 | 15.4 | 15.1 | 16.4 | 16.0 | 15.9 | 15.5 |
| Southwest | 21.4 |  | 11.0 | 12.3 | 12.5 | 12.6 | 13.1 | 12.8 | 15.7 | 14.2 | 13.9 | 13.2 |
| Central | 8.9 |  | 7.5 | 8.0 | 8.0 | 7.9 | 8.1 | 8.0 | 8.4 | 8.0 | 8.2 | 8.0 |
| *Total* | *73.1* | *62.8* | *53.2* | *56.0* | *56.3* | *56.6* | *57.9* | *56.9* | *62.8* | *59.5* | *59.3* | *57.7* |
| California - |  |  |  |  |  |  |  |  |  |  |  |  |
| *Total* | *13.9* | *11.3* | *10.0* | *10.5* | *10.5* | *10.4* | *10.5* | *10.5* | *10.6* | *10.9* | *10.3* | *10.8* |
| All States - |  |  |  |  |  |  |  |  |  |  |  |  |
| ***TOTAL*** | ***144.9*** | ***125.4*** | ***112.9*** | ***116.6*** | ***116.9*** | ***117.0*** | ***118.6*** | ***117.5*** | ***123.7*** | ***120.9*** | ***119.8*** | ***118.7*** |

[1] Includes self-employed in all solid wood products and pulp and paper sectors. Wage and salary employment is approximately 7.5 percent less than total employment. The study area includes the counties that fall, whole or in part, within the range of the northern spotted owl.

# Chapter 1
# Purpose and Need

# Chapter 1
# Purpose and Need

**KEY TERMS**

**Code of Federal Regulations (CFR)** - A codification of the general and permanent rules of the Executive departments and agencies.

**Ecosystem Approach** - A strategy to manage ecosystems to provide for all associated organisms.

**Late-Successional Forests** - Forest seral stages which include mature and old-growth age classes.

**Old-Growth Forest** - A forest over 180-220 years old with a multilayered, multispecies canopy dominated by large overstory trees; large snags; and large logs on the ground.

**Range of the Northern Spotted Owl** - Generally, lands in western Washington and Oregon, and northern California. See Figure 2-1 in Chapter 2.

*Definitions are condensed from those in the glossary in this document.*

## Introduction

This chapter specifies the underlying purpose and need to which the Forest Service and Bureau of Land Management (BLM) are responding in developing this Draft Supplemental Environmental Impact Statement (Draft SEIS). The Fish and Wildlife Service, Environmental Protection Agency, National Marine Fisheries Service, and the National Park Service are assisting as cooperating agencies. This Draft SEIS assesses alternatives for managing the Federal forests of the Pacific Northwest and northern California within the range of the northern spotted owl (*Strix occidentalis caurina*).

## Background

The ongoing controversy concerning management of Federal lands has resulted in what has been described as a gridlock of lawsuits, court rulings, appeals and protests (*see Appendix D, Related Direction and Activities*). The public debate has expanded from a focus on management of northern spotted owl habitat to include all old-growth forest associated species and old-growth ecosystems. The Scientific Analysis Team Report (Thomas et al. 1993) offers an overview of the controversy in its Appendix 1-A, "An Historical Perspective on the Evolution of the Spotted Owl Issue and Its Incorporation Into *de facto* Forest Management Policy."

Recent court rulings require completion of environmental impact statements. The Forest Service is required by the U.S. District Court for the Western District of Washington to prepare a new or supplemental Environmental Impact Statement (EIS) to correct deficiencies in the *Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests* (USDA 1992). The

BLM is required by the U.S. District Court for the District of Oregon to prepare an EIS to incorporate new information on the effects of logging on the northern spotted owl and to consult on a conservation strategy. Both agencies are currently enjoined from selling timber in northern spotted owl habitat.

In order to seek a solution to the controversy, President Clinton held a Forest Conference in Portland, Oregon, on April 2, 1993. During the daylong conference, scientists, economists, representatives from the forest products industry and environmental groups, and others were invited to present concerns, opinions, or proposals to the President concerning the various issues surrounding the management of Federal lands in the Pacific Northwest and northern California.

After the Forest Conference, the Forest Ecosystem Management Assessment Team ("the Assessment Team") was assembled to prepare an assessment that took an ecosystem approach to forest management (see Appendix C, Letters of Direction). This Draft SEIS discloses the environmental effects of the options (alternatives) developed and evaluated by the Assessment Team. For the Forest Service, this SEIS will supplement the *Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests* (USDA 1992). For the Bureau of Land Management, this SEIS will supplement the Draft Environmental Impact Statements for the Draft Resource Management Plans for the Salem, Eugene, Coos Bay, Roseburg, Medford, and Klamath Falls Resource Area of the Lakeview District in Oregon. It will also supplement BLM's King Range National Conservation Area Management Plan, and the Final Environmental Impact Statements for the Resource Management Plans for the Arcata and Redding Resource Areas of the Ukiah District in California.

The Assessment Team's work built on the analyses in earlier plans and environmental impact statements for lands administered by the Forest Service and BLM. The regional scope of this analysis prohibits site-specific detail in this SEIS.

## THE UNDERLYING NEED

The Forest Service and the Bureau of Land Management have a need to coordinate the management of the lands they administer within the range of the northern spotted owl to maintain and restore biological diversity as it applies to late-successional and old-growth forest ecosystems.

## THE PROPOSED ACTION

The proposed action is to adopt coordinated management direction for the lands administered by the Forest Service and the Bureau of Land Management within the range of the northern spotted owl and to protect and enhance late-successional and old-growth forest ecosystems. The action amends the management direction established in all existing plans for the areas and resources covered by this SEIS. This new management direction will apply to projects which will be conducted after site-specific environmental analysis. The existing management plans to be amended include existing Regional Guides, Forest Plans, Unit Plans, Timber Management Plans, Management Framework Plans, and Resource Management Plans for lands within the range of the northern spotted owl. The coordinated management direction established by the Record of Decision for this SEIS will also be incorporated into all land management plans within the range of the northern spotted owl as they are completed or revised.

## THE PURPOSE OF THE PROPOSED ACTION

The purpose, which includes President Clinton's mandate and principles as expressed at the April 2, 1993, Forest Conference, is to take an ecosystem approach to forest management; maintain and restore biological diversity as it applies to late-successional and old-growth forest ecosystems; maintain a sustained yield of renewable natural resources, including timber, other forest products, and other forest values; and maintain rural economies and communities.

## SCOPING

Scoping is the term used for identifying issues, concerns and opportunities in an environmental impact statement. In this case, scoping focuses on the management of late-successional and old-growth forests on Federal lands. Most recently, President Clinton's Forest Conference served as a focal point to discuss the issues surrounding management of late-successional and old-growth forests on Federal lands within the range of the northern spotted owl. At the conclusion of that conference, he directed the members of his Cabinet to prepare a plan and enunciated five principles to guide the formulation of that plan:

> *First, we must never forget the human and the economic dimensions of these problems. Where sound management policies can preserve the health of forest lands, sales should go forward. Where this requirement cannot be met, we need to do our best to offer new economic opportunities for year-round, high-wage, high-skill jobs.*
>
> *Second, as we craft a plan, we need to protect the long-term health of our forests, our wildlife, and our waterways. They are, as the last speaker said, a gift from God; and we hold them in trust for future generations.*
>
> *Third, our efforts must be, insofar as we are wise enough to know it, scientifically sound, ecologically credible, and legally responsible.*
>
> *Fourth, the plan should produce a predictable and sustainable level of timber sales and nontimber resources that will not degrade or destroy the environment.*
>
> *Fifth, to achieve these goals, we will do our best, as I said, to make the Federal government work together and work for you. We may make mistakes but we will try to end the gridlock within the Federal government and we will insist on collaboration not confrontation.*

Following the Forest Conference, representatives of the Administration held meetings with interested parties to solicit their ideas. In addition, the Forest Ecosystem Management Assessment Team received and considered numerous submissions from interested groups and members of the public. The Forest Conference and the subsequent meetings and submissions served to confirm and specify the scope of the issues, potential effects and appropriate analysis.

Moreover, the issues surrounding the management of late-successional and old-growth forest ecosystems to be addressed in this SEIS have been before the public and discussed for a number of years. Congress has held a number of hearings on these issues. A report entitled *Alternatives for Management of Late-Successional Forests of the Pacific Northwest* (Johnson et al. 1991) was prepared at the request of the Agriculture Committee and the Merchant Marine and Fisheries Committee of the U.S. House of Representatives in October 1991.

The Forest Service has completed Forest Plans for most of the National Forests within the range of the northern spotted owl, and is preparing Draft Forest Plans for the remaining ones. Additionally, scoping for these Forest Plans and the *Final Supplement to the Environmental Impact Statement for an Amendment to the Pacific Northwest Regional Guide* (USDA 1988) included issues regarding management of late-successional and old-growth forests, and served to focus the public on the issues. The Forest Service more recently received extensive public comment on the *Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests* (USDA 1992).

The Fish and Wildlife Service elicited comments when it proposed listing the northern spotted owl and marbled murrelet. They also held public hearings during the summer of 1991 on the proposed designation of critical habitat for the northern spotted owl, and have more recently received comments on the *Recovery Plan for the Northern Spotted Owl - Draft* (USDI 1992b). During the spring of 1992, there was public comment and discussion in connection with the hearings conducted by the Endangered Species Committee ("the God Squad") on a proposed exemption to the Endangered Species Act.

The Bureau of Land Management is in the process of preparing Resource Management Plans (RMPs) for its Districts in western Oregon, and has completed plans for the lands they administer in California within the range of the northern spotted owl. Scoping for these plans identified issues surrounding the management of late-successional and old-growth forest ecosystems. Between 1986 and 1992, the Bureau of Land Management conducted scoping and solicited and received public comments regarding these issues.

All of these efforts by Congress and the relevant land and resource management agencies, coupled with the actions during and after the Forest Conference, have served to focus the issues such that additional scoping is not necessary (Appendix C, June 21, 1993, letter from the Council on Environmental Quality). Also, as stated in the regulations at 40 CFR 1502.9(c)(4), additional scoping is not required for a supplement to an environmental impact statement. Other requirements for preparation, circulation and filing of an SEIS, however, remain the same as for an EIS.

# Chapter 2

# The Alternatives

# Chapter 2
# The Alternatives

**KEY TERMS**

**Adaptive Management -** The process of changing land managemnt as a result of monitoring or research.

**Administratively Withdrawn Areas -** Areas removed from the suitable timber base an agency.

**Alternative -** One of several proposed plans.

**Congressionally Withdrawn Areas** (Congressional Reserves) - Areas withdrawn from agency land management decision by Congress.

**Viability -** The ability of a population to persists over time.

## Introduction

Chapter 2 discusses the issues and presents 10 alternatives for accomplishing the proposed action. Each alternative is an ecosystem management plan for managing habitat for late-successional and old-growth forest related species, including the northern spotted owl, on lands administered by the Forest Service and the Bureau of Land Management (BLM) within the range of the northern spotted owl.

Each alternative consists of combinations of land allocations managed primarily to protect and enhance habitat for late-successional and old-growth forest related species, and standards and guidelines for the management of the land allocations. Following these alternatives is a discussion of the alternatives considered but eliminated from detailed study. A comparison of their major effects is presented at the end of the chapter.

The preferred alternative in this Draft SEIS is Alternative 9.

# THE ISSUES

For over two decades there has been growing controversy over managing old-growth forests on Federal lands. When harvested, they have great economic value and make way for younger forests and the wildlife they support. If preserved, they provide an environment for many species and contribute to forest values and environmental qualities. This description of the issues is based on past documents, public comments, court cases, media reports and features, and transcripts of the April 2, 1993, Forest Conference. These issues serve to focus the comparison of the alternatives.

At the Forest Conference, President Clinton posed the fundamental question in his opening remarks:

> *How can we achieve a balanced and comprehensive policy that recognizes the importance of the forests and timber to the economy and jobs of this region, and how can we preserve our precious old-growth forests, which are part of our national heritage and that, once destroyed, can never be replaced?*

President Clinton continued:

> *The most important thing we can do is to admit, all of us to each other, that there are no simple or easy answers. This is not about choosing between jobs and the environment, but about recognizing the importance of both and recognizing that virtually everyone here and everyone in this region cares about both.*

The region's ecological systems are complex and varied. Managing these ecosystems to preserve and enhance late-successional and old-growth forests will have major effects on the overall structure, function, and appearance of the region's forests; the water quality in streams and rivers; and the distribution, connectivity, diversity, and sustainability of its terrestrial and aquatic communities.

In the last decade, the northern spotted owl became the focus in the debate over how Federal forest lands should be managed. The management of habitat for late-successional and old-growth related species affects other terrestrial and aquatic species and the region's ecological systems collectively. There are 42 federally-listed threatened or endangered species which may occur within the range of the northern spotted owl, including the spotted owl and the marbled murrelet. Nine of these listed species use Federal Forested habitats. The long-term persistence of the spotted owl and other old-growth related species depends on adequate, usually well-distributed habitat for their life functions.

The set of factors affecting long-term persistence of these species, including the northern spotted owl, is complex and not precisely known. While most people want the spotted owl and other old-growth species to survive, there is disagreement over the size of populations that should be provided for, and the forest management that will ensure long-term survival.

Aquatic and riparian areas are integral parts of the region's ecosystems, and major factors in supporting the economy of the region. Damage to forest aquatic and riparian systems has contributed to degradation of some plant and animal communities. Of immediate concern is the loss of salmon and steelhead runs, which are major cultural and economic elements in the Pacific Northwest and northern California. The concern is both for the numbers of fish and for their genetic diversity.

Since World War II, timber management has been a major part of the Forest Service and Bureau of Land Management's role of actively managing Federal lands for a variety of sustainable benefits for the Nation. The timber management program on Federal forests within the range of the northern spotted owl has focused on harvesting older forest areas for timber and replacing them with faster-growing young stands. Older forests are essential habitat for many species; as the amount of older forests decreased, the survival of old-growth related species, including the northern spotted owl became more uncertain.

Managing Federal lands to provide habitat for northern spotted owls and other old-growth related species will result in a change in the extent and rate of harvest of older forest areas, as well as changes in how other forest areas are managed. Management to maintain or increase diversity of the forest's structure and function is itself an issue. Species that need young forests and species that need older forests are affected in different ways by changes in the age, composition, and distribution of the habitat they need, became more uncertain.

The BLM and Forest Service's timber management programs provide raw material for the wood products industry that, after milling and processing, serves the needs of a variety of consumers. The wood products industry's principal employment is located in small cities, towns, and rural areas. From 1986 to 1990, wood from Federal forests supported half the industry's jobs. Additionally, a quarter of the receipts from timber sales on Federal lands (and half from "O&C lands") go to county governments.

Reductions in the amount of timber sold for harvest directly affect employment and the economic health of the forestry and wood products industries. These, in turn, immediately affect the economic vitality of the communities dependent on them, and the well being of workers and families. These changes threaten the ability of some of these communities and their institutions to survive.

There are other human uses of Federal forest lands that will be enhanced, maintained or curtailed in managing habitat for the northern spotted owl and other late-successional and old-growth related species. Road construction and use, recreation, mining, and other land uses will be affected. There are alternate paths for people and communities to take to adjust to changes. The effectiveness of those paths and the human costs of making those changes are both dynamic and significant issues.

## CONSULTATION

Consultation on the preferred alternative will be conducted with the Fish and Wildlife Service and the National Marine Fisheries Service in accordance with Section 7 of the Endangered Species Act. Formal consultation on the SEIS will be completed prior to the Final SEIS. Actions proposed to implement the selected alternatives will undergo consultation, either formal or informal, as appropriate.

Under the selected alternative, appropriate consultation under the Coastal Zone Management Act will take place with the appropriate state(s) concerning those activities which take place within the coastal zone.

## CRITICAL HABITAT

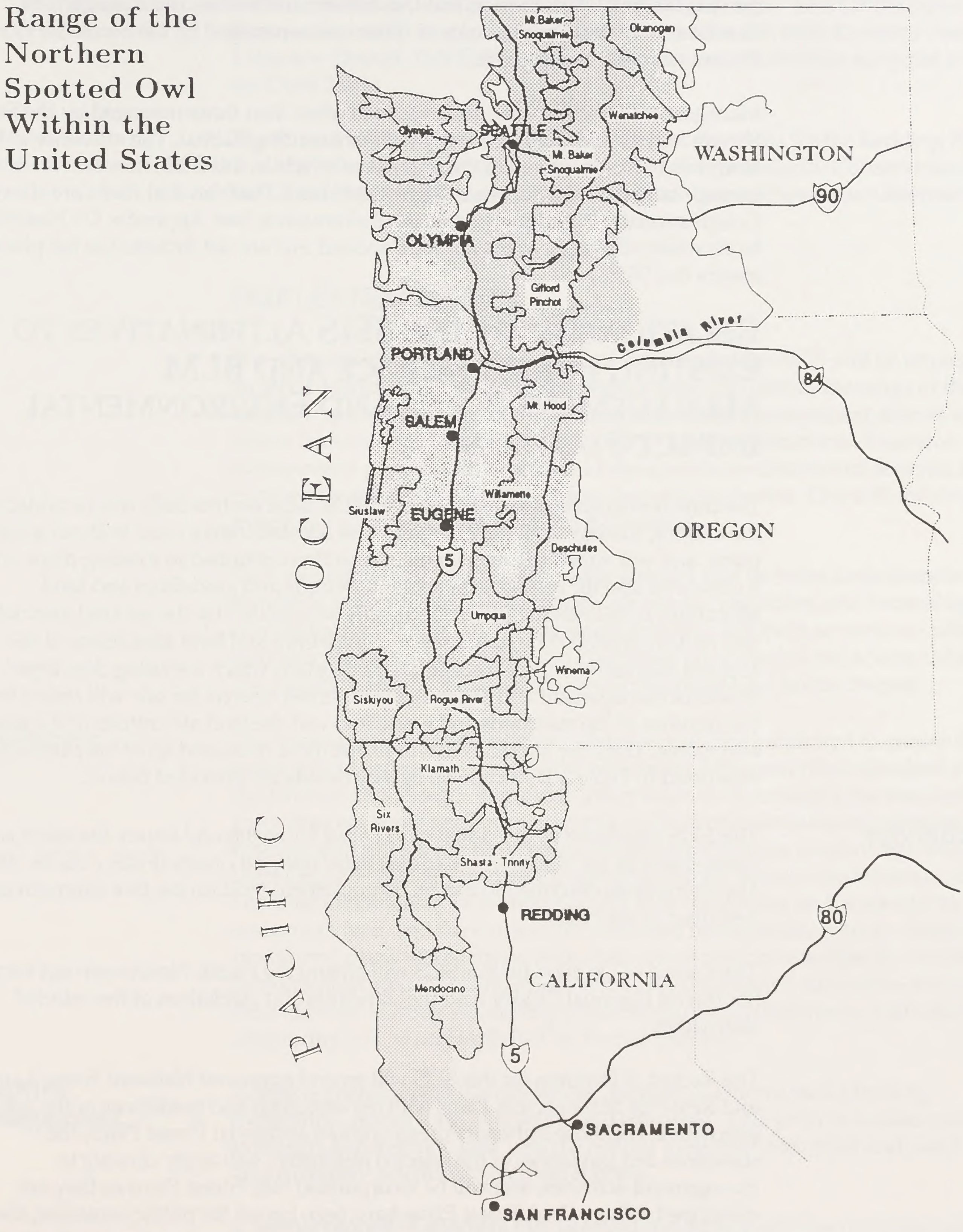
In January 1992 the Fish and Wildlife Service determined the lands that comprise critical habitat for the northern spotted owl. Regardless of which alternative is selected in the Record of Decision for this SEIS, the Forest Service and Bureau of Land Management will consult on any proposed actions that may affect critical habitat (50 CFR 402.14). The appropriateness of future proposed actions in critical habitat will be determined through consultation, informal or formal, with the Fish and Wildlife Service according to Section 7(a) of the Endangered Species Act. The Fish and Wildlife Service may review and revise its critical habitat designation based on the final alternative selected.

## THE PLANNING AREA

Three components contribute to the complexity of managing Federal lands: multiple agencies, intermingled lands, and a variety of planning requirements that have changed through the years. Because this SEIS proposes management direction for lands administered by both the Forest Service and Bureau of Land Management, descriptions of administrative units and references to management plans can be lengthy and confusing.

Therefore, in an effort to help the reader understand the alternatives presented in this SEIS, "the planning area" refers to lands administered by the Forest Service and the Bureau of Land Management within the range of the northern spotted owl. These lands are located in Washington, Oregon and northern California. See Figure 2-1 below and the map of Administrative Units in the accompanying map packet.

**Figure 2-1 Range of the Northern Spotted Owl Within the United States**



White the Forest Ecosystem Management Assessment Team (also referred to as the Assessment Team in this document) considered all Federal lands within the range of the northern spotted owl, including those managed by the Fish and Wildlife Service, National Park Service, and Department of Defense, the management direction in this SEIS applies only to those lands managed by the Forest Service and Bureau of Land Management.

Management direction other Federal lands other than those managed by the Forest Service and the BLM will generally maintain existing habitat. The influence of these lands has been considered in the analysis of effects in this SEIS, however no new management direction for them is presented here. The National Parks are shown as Congressionally Withdrawn Areas in all alternatives (see Appendix D). Nonfederal lands within the range of the northern spotted owl are not included in the planning area in this SEIS.

## RELATIONSHIP OF THE SEIS ALTERNATIVES TO EXISTING FOREST SERVICE AND BLM MANAGEMENT PLANS AND ENVIRONMENTAL IMPACT STATEMENTS

The direction established by the Record of Decision for this SEIS will be added to the existing management direction for those administrative units without adopted plans, and will supersede management direction contained in existing plans where it differs for specific resources or areas. Standards and guidelines and land allocations in the existing plans not directly superseded by the selected alternative will remain in effect. The standards and guidelines and land allocations of the selected alternative will be incorporated into plans which are being developed. Resource management and the quantity of timber offered for sale will reflect the implications of the standards and guidelines and the land allocations of the selected alternative. Thus, the alternatives will supplement or amend all of the plans and EISs listed in Table 2-1. Additional agency details are provided below.

### Forest Service

This SEIS supplements the January 1992 *Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests* (FEIS) (USDA 1992). The alternatives described in this SEIS supplement (add to) the five alternatives described in the FEIS.

The Record of Decision for this SEIS will amend the Pacific Northwest and Pacific Southwest Regional Guides with the standards and guidelines of the selected alternative.

The Record of Decision for this SEIS will amend approved National Forest Land and Resource Management Plans with the standards and guidelines of the selected alternative. For those National Forests without approved Forest Plans, the standards and guidelines of the selected alternative will apply directly to management activities, and will be incorporated into Forest Plans as they are developed. Where Draft Forest Plans have been issued for public comment, the alternatives in this Draft SEIS supplement the alternatives described in the Draft Forest Plans.

### Bureau of Land Management

The existing BLM Management Framework Plans for western Oregon Districts will be amended as a result of the direction established by the Record of Decision for this SEIS. This SEIS supplements the BLM Draft Resource Management Plans and Environmental Impact Statements (RMP/EISs) of August 1992 for the Salem, Eugene, Coos Bay, Roseburg, Medford, and the Klamath Falls Resource Area of the Lakeview District. This SEIS supplements the seven alternatives analyzed in each of the Draft Plans.

The Record of Decision for this SEIS will amend the plans for the Redding Resource Area, the Arcata Resource Area, and the King Range National Conservation Area of the Ukiah District with the standards and guidelines of the selected alternative.

## IMPLEMENTATION

The alternative selected in the Record of Decision for this SEIS will be implemented on lands administered by the Forest Service and BLM within the range of the northern spotted owl. Under the selected alternative, management actions will follow National Environmental Policy Act (NEPA) requirements. Resource management projects will be subject to site-specific environmental analysis and appropriate public participation before they are conducted. This will involve analysis of cumulative and other environmental.

Each alternative provides a region-wide strategy that includes land allocations, and standards and guidelines that cross physiographic provinces, and Federal agencies' administrative boundaries. Management activities will be in accordance with the land allocations, and standards and guidelines prescribed in the selected alternative. The specific strategy of each alternative is described later in this chapter.

### Monitoring

The implementation of the selected alternative will be monitored to ensure that management actions are meeting the objectives of the prescribed standard and guidelines. Monitoring will provide information to determine if the standards and guidelines are being implemented consistently (implementation monitoring), verify whether they are having the predicted effect (effectiveness monitoring), and determine whether key underlying assumptions are sound (validation monitoring). The level and intensity of monitoring will vary depending on the sensitivity of the resource or area, and the scope of the proposed management activity. Existing monitoring plans will continue to be used where appropriate. Specific monitoring protocols and guidelines will be developed for the selected alternative which will be used to revise existing monitoring plans. Some of the effectiveness and validation monitoring will be accomplished by formal research.

### Adaptive Management

Adaptive management is a continuing process of action-based planning, monitoring, researching, evaluating and adjusting. This process enables resource managers to determine how well the actions meet their objectives and what steps to take to modify activities to increase success.

A formal process of adaptive management including watershed analyses will be implemented to maximize the benefits of the selected alternative. This may result in the refinement of standards and guidelines or amendments to Forest Service and BLM plans. Adaptive management modifications which require changes to Regional Guides, Forest Plans or RMPs will be adopted following applicable regulatory procedures. It is anticipated that many adaptive management modifications will not require changes to Regional Guides, Forest Plans or RMPs.

While the adaptive management concept applies to the entire ecosystem described in each alternative, the "Adaptive Management Areas" of Alternative 9 are specific land allocations. The primary objective of the 10 Adaptive Management Areas in Alternative 9 is development, demonstration, implementation and evaluation of monitoring programs and innovative management practices that integrate ecological and economic values.

## Interagency Coordination

The implementation of the selected alternative calls for a high level of coordination and cooperation among agencies. Together, agencies will discuss issues, clarify objectives, and work out solutions in collaboration. Existing planning procedures may be used in the near term as specific proposed changes are implemented. Specific proposed interagency structures and interagency actions are described in the Report of the *Agency Coordination Working Group* (Appendix E). Major elements of the proposals of that group include:

**New Planning Units**–Implementation of the selected alternative will involve a change in focus. Under the new approach, analysis starts at the watershed level and the most logical planning unit is a physiographic province or river basin, consisting of a number of watersheds. Watershed-based planning will be implemented and over time the agencies will switch from existing planning units to these provinces or modify the boundaries of current planning units to be more compatible with the watershed-based approach.

**Interagency GIS Detabase**–Relevant agencies will immediately undertake the development of an interagency Geographic Information System (GIS) data base to enable them to coordinate their efforts in the collection and development of research and data.

**New Planning Structure**–Most of the planning work will be done by teams that will develop analyses for particular watersheds and clusters of watersheds. The membership of these teams will include the relevant Federal agencies, states, and tribes.

When individual watersheds are analyzed, the objective will be for members to jointly discuss the biological, economic, community and other needs. An

Interagency Executive Group will coordinate and provide direction for the work of provincial teams. Interagency efforts will also involve the use of a research and monitoring committee comprised of research scientists from a variety of disciplines to address issues of research and monitoring that are critical to adaptive management and to long-term success of the effort. In addition, a permanent regional ecosystem office will provide a focal point for dealing with issues relating to consultation, regional consistency, adaptive management, and data standards.

The *Agency Coordination Working Group* has proposed that legislative exemption from the Federal Advisory Committee Act (FACA) be sought to enable the interagency teams to fully involve nonfederal entities. Until such exemption is obtained, it may be necessary to limit participation in the interagency teams to Federal representation only, and coordinate with others informally and through existing processes, public hearings, meetings, and written comments.

This planning structure will be put into place as soon as practicable.

**Revised Consultation Process**–The existing administrative process of consultation under the Endangered Species Act will be revised to emphasize an integrated ecosystem approach. This will include involving Fish and Wildlife Service and the National Marine Fisheries Service early in the process, so their views *can be made known* when the land management agencies begin to develop their plans for a particular area.

## THE NO-ACTION ALTERNATIVE

The No-Action Alternative is comprised of the several existing plans described below (see Table 2-1). It is generally summarized in the 1992 FEIS, and the BLM August 1992 Draft Resource Management Plans/Environmental Impact Statements for western Oregon. For both agencies, the No-Action Alternative basically represents management direction that was in place immediately before the release of the Interagency Scientific Committee's (ISC): *A Conservation Strategy for the Northern Spotted Owl* (Thomas et al. 1990).

**Table 2-1 Description of the No-Action Alternative, and comparison of the No-Action Alternative with Alternative 7 and with "current plans and draft plan preferred alternatives".**

| | No-Action Alternative | Alternative 7 |
|---|---|---|
| Forest Service, Oregon and Washington | 1984 Regional Guide as amended in 1988. Existing Forest Plans for the Olympic, Mt. Baker-Snoqualmie, Gifford Pinchot, Okanogan, Wenatchee, Siuslaw, Mt. Hood, Willamette, Deschutes, Winema, Umpqua, Rogue River, and Siskiyou National Forests, approved 1988-1991 | Same |
| Bureau of Land Management, Oregon | Existing Management Framework Plans for the Salem, Eugene, Coos Bay, Roseburg, and Medford Districts; and the Klamath Falls Resource Area of the Lakeview District, approved during the late 1970s and early 1980s, and described in the respective August 1992 Draft RMP/EISs. | The Revised Preferred Alternative (see Appendix B) to the Draft Resource Management Plans and EISs released August 1992 for the Salem, Eugene, Coos Bay, Roseburg, and Medford Districts, and the Klamath Falls Resource Area of the Lakeview District |
| USDA-Forest Service, California | 1984 Regional Guide. Existing Forest Plans for the Lassen and Modoc National Forests. The Preferred Alternative as of March 1990 for Draft Forest Plans being developed for the Klamath, Shasta-Trinity, Mendocino, and Six Rivers National Forests, as described in the 1992 FEIS. | 1984 Regional Guide. Existing Forest Plans for the Lassen and Modoc National Forests. The Preferred Alternative as of May 1993 for Draft Forest Plans being developed for the Klamath, Shasta-Trinity, Mendocino, and Six Rivers National Forests. |
| Bureau of Land Management, California | Existing Resource Management Plans for the Arcata and Redding Resource Areas, approved 1992 and 1993 respectively. Existing Management Plan for the King Range national Conservation Area, approved 1974. | Same |
| Owl Conservation Strategy, Forest Service and Bureau of Land Management, all states. | Preserve 1000-3000 acre Spotted Owl Habitat Areas (SOHAs) and Oregon Dept. of Fish and Wildlife Agreement Areas (Spotted Owl Management Areas-SOMAs) for an interacting network of owl pairs | Final Draft of the Northern Spotted Owl Recovery Plan, adapted by the Assessment Team. Provides for interacting network of Designated Conservation Areas (DCAs) each (generally) large enough to support 20 owl pairs, as well as other designated areas for individual or groups of owl pairs. |

The plans described in the **shaded area in Table 2-1** are referred to in this Draft SEIS as "current plans and draft plan preferred alternatives", and are intended by the Assessment Team to approximate direction that might have been implemented if the Federal Agencies had continued agency land and resource management planning. Standards and guidelines from these plans apply to all of the action alternatives where they provide greater benefits to late-successional and old-growth forest related species than other provisions of these alternatives. (National Forests in California have proceeded with their planning process and expect to issue Draft Forest Plans in the summer of 1993 which will more closely reflect the standards and guidelines of Alternative 9 in this Draft SEIS.)

As noted earlier in this chapter under Relationship of the SEIS Alternatives to Existing Forest Service and BLM Management Plans and Environmental Impact Statements, the action alternatives presented in this SEIS would supplement all of the plans and related environmental impact statements listed in Table 2-1.

The No-Action Alternative described here is the same as that described in Environmental Impact Statements which this Draft SEIS supplements, and is consistent with CEQ requirements to present "no change" from current management direction or level of management intensity. However, because of recent listings of the marbled murrelet and the northern spotted owl under the Endangered Species Act, the designation of critical habitat for the northern spotted owl, concern over threatened fish stocks, and other recent information regarding the management of habitat for other old-growth and late-successional related species, the No-Action Alternative is no longer implementable, nor does it meet the purpose and need for this Draft SEIS (see Appendix C, letter from Council of Environmental Quality).

Normally the No-Action Alternative is described within an Environmental Impact Statement, even where it is not implementable, to serve as a baseline for comparison of effects among the action alternatives. The No-Action Alternative, if viewed as described above without recent, legally required changes, might be assumed to be represented by effects displayed in Chapter 3&4 as "1980-1989 Average" or equivalent.

# INTRODUCTION TO THE ACTION ALTERNATIVES

The 10 action alternatives presented in this Draft SEIS are comprised of the 10 ecosystem management options developed by the Forest Ecosystem Management Assessment Team and described in detail in their FEMAT Report. No changes to the land allocations or standards and guidelines were intended in presenting them as alternatives in this document.

The alternatives apply to lands administered by the Forest Service and Bureau of Land Management within the range of the northern spotted owl. Each alternative assumes other Federal lands, such as those administered by the Fish and Wildlife Service, National Park Service, and Department of Defense, will be managed according to existing management plans and applicable Federal law.

**Current Plans and Draft Plan Preferred Alternatives -** Standards and guidelines of the current plans and draft plan preferred alternatives apply to all alternatives where they provide greater benefits to late-successional and old-growth related species than the provisions of these alternatives. The current plans and draft plan preferred alternatives referred to in this SEIS are shown in the shaded area in Table 2-1.

For the four National Forests in northern California, all the alternatives are based on the preferred alternatives as of May 1993 for the Forest Plans that were being prepared. However, these National Forests have since developed updated preferred alternatives which now reflect closely the management direction in Alternative 9.

Since current plans and draft plan preferred alternatives contain preferred alternatives not previously included in "approved" agency plans, they differ from the "No Action" Alternative described in the previous section of this chapter.

## How the Alternatives are Structured

Like other recent strategies for management of northern spotted owl habitat or old-growth forests in the Pacific Northwest, the alternatives presented in this Draft SEIS propose a network of designated areas managed primarily to protect and enhance habitat for the northern spotted owl and other late-successional and old-growth forest related species (hereafter referred to as designated areas), and nondesignated areas referred to as the matrix. Within each of these areas, standards and guidelines set management direction and apply to management activities. Appendix B contains additional information about particular standards and guidelines, or processes.

**LAND ALLOCATION CATEGORIES**

**Designated Areas**

- Congressionally Reserved
- Late-Successional Reserves
- Managed Late-Successional Areas
- Adaptive Management Areas
- Administratively Withdrawn Areas
- Riparian Reserves

**Matrix**

- Matrix

## LAND ALLOCATIONS

There are 24,260,700 acres of Federal land within the range of the northern spotted owl. Each of the alternatives in this Draft SEIS allocates these acres to one of the following six categories of designated areas, or to the matrix. The categories are listed in the order that acreage was tabulated, and not necessarily in the order that corresponding standards and guidelines apply. These categories are:

### DESIGNATED AREAS

**Congressionally Reserved** - All alternatives retain land allocations for existing lands that are Congressionally reserved. These include designated Wilderness, Wild and Scenic Rivers, National Wildlife Refuges, National Parks, certain Research Natural Areas, and others. The location and size of these areas does not change among the alternatives. Management of these lands follows direction written in the applicable legislation or plans.

**Late-Successional Reserves** - Late-Successional Reserves are identified for each alternative. These areas would be managed to protect and enhance habitat for late-successional and old-growth related species including the northern spotted owl. For most alternatives, some level of silvicultural treatment (such as thinning young stands) is permitted in certain age stands in order to accelerate the development of old-growth habitat characteristics (see Appendix B, Principles for Management). These reserves are designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem.

**Managed Late-Successional Areas** - Managed Late-Successional Areas are identified for some alternatives in areas where regular and frequent fire was a natural part of the ecosystem. The objective within these areas is to produce and maintain an optimum level of late-successional and old-growth stands on a landscape scale. In these designated areas, certain silvicultural treatments and fire hazard reduction treatments are allowed in order to help prevent destroying the stands completely as a result of large catastrophic events such as high intensity, high severity fires, disease, or insect epidemics.

**Adaptive Management Areas** - Adaptive Management Areas occur only under Alternative 9. The objective for each of these areas is to learn more about ecosystem management while meeting social and economic objectives. Each area has a different emphasis to its prescription, such as maximizing the amount of late-successional forests or improving riparian conditions through silvicultural treatments. A complete description of the purpose for each Adaptive Management Area, as well as specific objectives, is in Appendix B, Adaptive Management Areas.

**Administratively Withdrawn Areas** - Standards and guidelines of the current plans and draft plan preferred alternatives apply where they provide greater benefits to late-successional and old-growth related species than other provisions of these alternatives. Administratively Withdrawn Areas are those areas not scheduled for timber harvest and are not included in calculations of allowable sale quantity (ASQ). Administratively Withdrawn Areas include recreation areas, lands not technically suitable for timber production, certain visual retention and riparian areas, areas removed from timber production for the protection for locally endemic species, and others.

**Riparian Reserves** - The Riparian Reserves provide a buffer along all streams, wet areas, ponds, lakes, and unstable and potentially unstable areas (see Appendix B, Aquatic Conservation Strategy). Riparian Reserves are not mapped, however insets of sample areas on the alternative maps in the map packet show sample distributions of riparian reserves.

### MATRIX

**Matrix** - The matrix consists of those Federal lands outside the six categories of designated areas listed above. Most timber harvest and other silvicultural activities would be conducted in the matrix, according to standards and guidelines. All **scheduled** timber harvest (i.e., that contributing to the ASQ) takes place in the matrix. Many of the alternatives apply the ISC Conservation Strategy's 50-11-40 rule for management of the matrix. Each alternative also specifies the amount of green trees, snags, and logs that will be left following management activities.

**Use of the Term Reserves** - Some sections of this Draft SEIS and the FEMAT Report refer to "reserves". This term generally refers to the Congressional Reserve, Late-Successional Reserves, and Riparian Reserves.

## Elements from Previous Documents Incorporated into Alternatives by the Assesment Team

In developing the options on which the action alternatives are based, the Forest Ecosystem Management Assessment Team borrowed from previous efforts by the Federal government to develop a strategy for management of habitat for the northern spotted owl and/or other old-growth associated species. The following is a list of these efforts:

1. The Interagency Scientific Committee prepared *A Conservation Strategy for the Northern Spotted Owl* (Thomas et al. 1990). Three sets of clarifying questions and answers were released after the report (Mays and Mulder 1991, Thomas 1991, USDA 1991).

2. At the request of the Agriculture Committee and the Marine and Fisheries Committee of the U.S. House of Representatives, the Scientific Panel on Late-Successional Forest Ecosystems (also referred to as the Scientific Panel) prepared its report *Alternatives for Management of Late-Successional Forests of the Pacific Northwest* (Johnson et al. 1991).

3. In 1992 the Northern Spotted Owl Recovery Team prepared the *Final Draft of the Recovery Plan for the Northern Spotted Owl* (USDI 1992a). The standard and guidelines for Federal lands from this document are included in Appendix B of this Draft SEIS.

4. In 1993 the Scientific Analysis Team (SAT) released its report *Viability Assessments and Management Considerations for Species Associated with Late-Successional and Old-Growth Forests of the Pacific Northwest* (Thomas et al. 1993). This document includes recommendations of the Pacific Salmon Working Group, also known as PacFish.

The documents above identify and describe various land allocations and/or standards and guidelines designed to meet specific management objectives or themes. The Assessment Team incorporated these elements into one or more of their 10 options; subsequently they appear in the alternatives in this Draft SEIS. Further details for specific standards and guidelines can be found in the parent documents listed above.

These elements are described as follows and are referred to in the description of each alternative by element title only. The standards and guidelines for an element are not always the same, depending on the alternative. Where an element carries the same standards and guidelines regardless of the alternative, the standards and guidelines are included with the description of the element below. Otherwise, they are found in the descriptions of the alternatives.

**LS/OG1, LS/OG2 and LS/OG3** - The Scientific Panel classified late-successional and old-growth forests as most ecologically significant (LS/OG1), ecologically significant (LS/OG2), and the remainder (LS/OG3, generally any forest over 80 years old). The Scientific Panel only mapped the LS/OG1 and LS/OG2 for its report (Johnson et al. 1991).

**Spotted Owl Additions** - The Scientific Panel also mapped areas that, when added to LS/OG1, brought the LS/OG1 reserves into compliance with the population standards of *A Conservation Strategy for the Northern Spotted Owl* (Thomas et al. 1990).

**Protection Buffers for Other Species** - The Scientific Analysis Team provided specific standard and guideline recommendations for nine species at risk, to be applied to lands occupied by these species which are outside of designated areas (Thomas et al. 1993:295-299)(see Appendix B, Protection Buffers). The nine species are: the Del Norte salamander, white-headed woodpecker, black-backed woodpecker, pygmy nuthatch, flammulated owl, great gray owl, American marten, fisher, and lynx. The FEMAT Report has applied these Scientific Analysis Team guidelines to most of the action alternatives. Where applied to an alternative, some of these requirements add lands to designated areas, while the remainder predominantly affect the matrix standards and guidelines, generally on a localized basis.

**Designated Conservation Areas (DCAs), Reserved Pair Areas, Residual Pair Areas, and Managed Pair Areas** - These are areas designated in the Final Draft of the Northern Spotted Owl Recovery Plan to be managed to improve northern spotted owl habitat. They are similar to, and based on, the Habitat Conservation Areas (HCAs) recommended by the Interagency Scientific Committee (Thomas et al. 1990). While the *Final Draft of the Northern Spotted Owl Recovery Plan* was completed by the Recovery Team in December 1992, it was not signed and therefore was not distributed to the public. Because some alternatives incorporate these areas, the applicable standards and guidelines have been adapted for this SEIS and are included in Appendix B, Recovery Plan Standards and Guidelines.

**Riparian Reserves** - Riparian Habitat Conservation Areas were proposed by the Scientific Analysis Team (Thomas et al. 1993). These reserves or variations of them, were incorporated by the Assessment Team into each alternative except 7, and specify a reserve width on each side of fish-bearing, nonfish-bearing, and intermittent streams as well as around wet areas, ponds, lakes, and unstable and potentially unstable lands (see Appendix B, Aquatic Conservation Strategy). The standards and guidelines prohibit activities not designed specifically to maintain and restore the structure and function of the reserve and benefit fish habitat. Salvage of dead trees following catastrophic events (e.g., fire, flood, volcanic eruption, wind, or insect infestation) is allowed only when woody debris guidelines are met and other riparian management objectives are not adversely affected. Roads would be managed to reduce sediment delivery to streams, grazing practices would be modified to reduce impacts, and mining impacts would be limited. Specific standards and guidelines for various resource managment activities are included in Appendix B, Aquatic Conservation Strategy.

In summary Riparian Reserve widths are prescribed for three categories of streams:

1. Fish-bearing streams, lakes, reservoirs
2. Permanently flowing nonfish-bearing streams, ponds, wetlands greater than 1 acre
3. Intermittent streams and wetlands less than 1 acre

Riparian Reserve widths are prescribed in terms of the height of a "site-potential tree" or site-specific geomorphic criteria such as 100–year floodplain, whichever is greater (see Appendix B, Aquatic Conservation Strategy). A site-potential tree height is the average maximum height of the tallest dominant tree (200 years or more) for a given site class. The reserve widths specified for each of these categories are interim widths until results of watershed analysis (see Appendix B, Aquatic Conservation Strategy) demonstrate that an adjustment is appropriate. Adjustments require approval of the interagency oversight team.

In Alternative 7, riparian reserves would be managed according to current plans and draft plan preferred alternatives.

**The 50-11-40 Rule** - This rule states that for every quarter-township, timber harvest shall be permitted only when 50 percent of the Federal forest landscape consists of forest stands with an average dbh of 11 inches and a canopy closure of 40 percent (Thomas et al. 1990). Riparian Reserves and Administratively Withdrawn Areas contribute toward meeting the 50-11-40 rule.

## Elements From the FEMAT Report Incorporated Into the Alternatives

As in the documents cited above, the FEMAT Report also identifies and describes various land allocations and/or standards and guidelines designed to meet specific management objectives or themes. As above, these elements are described here and then referred to in the description of each alternative by title only.

**Marbled Murrelet** - The area close to marine environments associated with most marbled murrelet activity is referred to as zone 1. Zone 1 is shown on the Federal Land Ownership map included with this Draft SEIS and extends approximately 40 miles inland in Washington, 35 miles inland in Oregon, 25 miles inland in California north of Fort Bragg, and 10 miles inland south of Fort Bragg. Some alternatives allocate certain older stands within zone 1 to designated areas. While a zone 2 has also been defined for survey purposes, it does not affect allocations for any of the alternatives.

All alternatives require preproject surveys of marbled murrelet habitat according to current Fish and Wildlife Service protocol. Current protocol requires two years of survey to assure no marbled murrelet nests exist in areas planned for timber harvest. If behavior indicating occupation is documented (see below), all contiguous existing and recruitment habitat for marbled murrelets (i.e., stands that are capable of becoming marbled murrelet habitat within 25 years) within a 0.5 mile radius will be protected. The 0.5 mile radius circle should be centered on either the behavior indicating occupation, or within 0.5 miles of the location of the behavior, whichever maximizes interior old-growth habitat. When occupied areas are close to each other, the 0.5 mile circles may overlap. In all alternatives, timber harvest is prohibited within occupied marbled murrelet habitat at least until completion of the Marbled Murrelet Recovery Plan (in preparation). When objectives of the Marbled Murrelet Recovery Plan have been identified, this standard will be reevaluated.

Behavior indicating murrelet occupation includes at least one of the following: (a) discovery of an active nest or a recent nest site as evidenced by a fecal ring or eggshell fragments; (b) discovery of a chick or eggshell fragments on the forest floor; (c) birds flying below, through, into, or out of the forest canopy within or adjacent to a stand; (d) birds perching, landing, or attempting to land on branches; (e) birds calling from a stationary location within the stand; (f) birds flying in small or large radius circles above the canopy (Ralph et al. unpub. 1992).

**Key Watersheds** - The Assessment Team identified Key Watersheds by building on previous work by the Scientific Panel on Late-Successional Forest Ecosystems and the Scientific Analysis Team. Key Watersheds are those watersheds containing at-risk anadromous salmonids, bull trout, and resident fish species, or are important sources of high quality water. Watershed analysis is required in these areas before any management activities can take place under all alternatives except Alternative 7. The exception to this is that, in the short-term and until Watershed Analysis can be completed, minor activities such as those that would be Categorically Excluded under NEPA regulations may proceed, consistent with riparian reserve standards and guidelines. In all alternatives except 7 and 8, no roads are to be constructed in inventoried roadless areas (as identified in Federal agency forest management plans) in all Key Watersheds. For Alternative 9, the Assessment Team attempted to locate Late-Successional Reserves within Key Watersheds wherever possible. Key Watersheds are not otherwise used for land and prescription allocations in any alternatives. There are two types of Key Watersheds:

> **Aquatic Conservation Emphasis Key Watersheds** (Tier 1, see Appendix B, Aquatic Conservation Strategy) These are shown on the Federal Land Ownership map included with this Draft SEIS and have been identified because of sensitive fish stocks or poor overall watershed condition. In some alternatives, Aquatic Conservation Emphasis Key Watersheds prescribe the interim Riparian Reserve widths that are different from reserve widths in other watersheds.
>
> **Other Key Watersheds** (Tier 2, See Appendix B, Aquatic Conservation Strategy) These have been identified because of existing superior watershed conditions. They do not appear on the Federal Land Ownership map.

**Other Watersheds** - Other watersheds refers to those not included above. Road construction in inventoried roadless areas will not occur until a watershed analysis indicates that construction is compatible with riparian and other ecological objectives. Watershed analysis is also required before Riparian Reserve widths can be adjusted, however analysis is not a prerequisite to other management activities.

An overview of the watershed analysis process and objectives is included in Appendix B, Aquatic Conservation Strategy. Additional information is presented in the FEMAT Report.

## STANDARDS AND GUIDELINES

All land allocations in each alternative have specific management direction regarding how those lands are to be managed, including actions that are prohibited and descriptions of the conditions that should occur there. This management direction for specific lands is known as "standards and guidelines"—the rules and limits governing actions, and the principles specifying the environmental conditions or levels to be achieved and maintained.

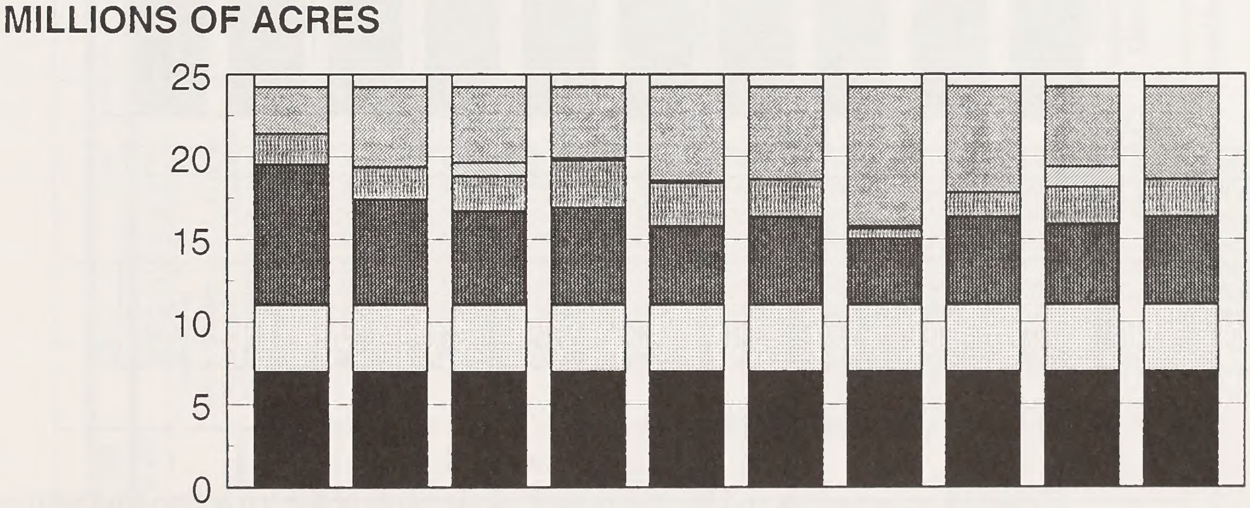
Some standards and guidelines vary from alternative to alternative, some are common to several alternatives, and some are common to all alternatives. Those common to all alternatives are included in the element descriptions above, and are not repeated under each alternative.

# COMPARISON OF FEDERAL LAND ALLOCATION BY ALTERNATIVE

All alternatives contain the same amount of Congressionally Reserved Areas (6.98 million acres). The total for Administratively Withdrawn areas is currently 4.05 million acres. There is considerable overlap between existing Administratively Withdrawals and the Late-Successional Reserves developed as part of the alternatives. As a result, there are two ways to compute the acreage involved in Late-Successional Reserves.

The first way is to consider Late-Successional Reserves as an addition to existing Administrative Reserves. This approach focuses on the cumulative impact of the reserves as additions to land that has already been Congressionally or Administratively Withdrawn from scheduled timber harvest. In that case, the total area of such Late-Successional Reserves varies between 8.53 million acres in Alternative 1 to 4 million acres in Alternative 7 (see Figure 2-2, Allocation of Federal Lands by Alternative. Late-Successional Reserves calculated *after* Administratively Withdrawn Areas).

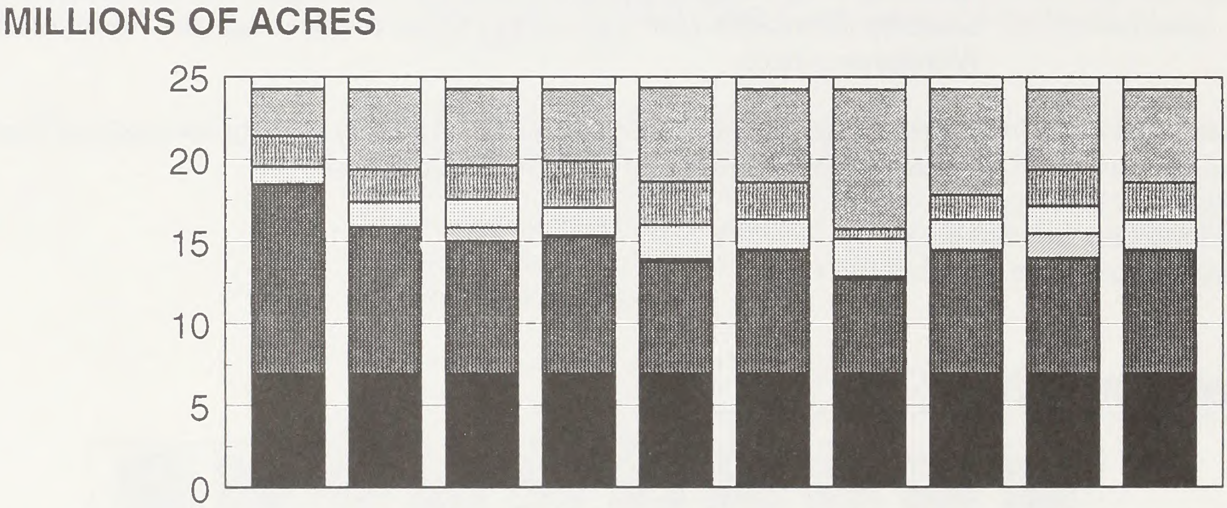
Figure 2-2 Allocation of Federal Lands by Alternative. (Late-Successional Reserves calculated *after* Administratively Withdrawn Areas).



| OPTIONS | Option 1 | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 | Option 7 | Option 8 | Option 9 | Option 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Congressionally Withdrawn ■ | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 |
| Administratively Withdrawn ░ | 4.05 | 4.05 | 4.05 | 4.05 | 4.05 | 4.05 | 4.05 | 4.05 | 4.05 | 4.05 |
| Late-Successional Reserves ▩ | 8.53 | 6.39 | 5.69 | 5.87 | 4.75 | 5.31 | 4.00 | 5.31 | 4.89 | 5.31 |
| Riparian Reserves ▥ | 1.87 | 1.99 | 2.12 | 2.88 | 2.65 | 2.29 | 0.62 | 1.50 | 2.23 | 2.29 |
| Managed L.S. Reserves ▧ | 0.00 | 0.00 | 0.85 | 0.15 | 0.15 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 |
| Adaptive Mgmt. Areas ▨ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.26 | 0.00 |
| Matrix ▦ | 2.83 | 4.85 | 4.58 | 4.33 | 5.69 | 5.64 | 8.46 | 6.43 | 4.85 | 5.64 |
| Total ☐ | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 |

The second way to calculate acreage of Late-Successional Reserves is to consider them as superseding the existing Administrative Reserves and including as Late-Successional Reserves the acreage that overlaps the two categories. In that case, the total area of Late-Successional Reserves varies from 11.50 million acres in Alternative 1 to 5.76 million acres in Alternative 7. (see Figure 2-3, Allocation of Federal Lands by Alternative. Late-Successional Reserves calculated *before* Administratively Withdrawn Areas). This method of calculation was chosen by the Assessment Team and the SEIS Interdisciplinary Team for acerage displays in the remainder of this Draft SEIS because, for some alternatives, the standards and guidelines for Late-Successional Reserves are more restrictive than for some Administratively Withdrawn Areas, and also because Administratively Withdrawn Areas are subject to revision during the Resource Management Plan and Forest Plan amendment or revision process.

Figure 2-3 Allocation of Federal Lands by Alternative. (Late-Successional Reserves calculated *before* Administratively Withdrawn Areas).



| OPTIONS | | Option 1 | Option 2 | Option 3 | Option 4 | Option 5 | Option 6 | Option 7 | Option 8 | Option 9 | Option 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Congressionally Withdrawn | ■ | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 | 6.98 |
| Late-Successional Reserves | ▦ | 11.50 | 8.92 | 8.04 | 8.26 | 6.81 | 7.52 | 5.76 | 7.52 | 7.05 | 7.52 |
| Managed L.S. Areas | ▧ | 0.00 | 0.00 | 0.85 | 0.15 | 0.15 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 |
| Adaptive Management Areas | ▨ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.49 | 0.00 |
| Administratively Withdrawn | ░ | 1.08 | 1.52 | 1.68 | 1.66 | 2.08 | 1.83 | 2.29 | 1.83 | 1.65 | 1.83 |
| Riparian Reserves | ▥ | 1.87 | 1.99 | 2.12 | 2.88 | 2.65 | 2.29 | 0.62 | 1.50 | 2.23 | 2.29 |
| Matrix | ▒ | 2.83 | 4.85 | 4.59 | 4.33 | 5.69 | 5.64 | 8.46 | 6.43 | 4.85 | 5.64 |
| Total | □ | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 | 24.26 |

## THE ALTERNATIVES

Table 2-2 summarizes and compares various elements of the ten action alternatives. This is followed by profiles of each individual alternative.

Alternatives 2, 6, and 10 were not analyzed by the Assessment Team in the same detail as the other seven action alternatives. For example, Alternatives 2 and 6 were not included in the second round of viability analyses, and Alternative 10 was developed after the viability analysis was completed. However, since these three alternatives are made up of components present in one or more of the other alternatives, the principle effects of these alternatives can be described. Therefore, these three alternatives are described here in Chapter 2 with the other action alternatives, and included in Chapter 3&4 only for those parameters for which effects can be described.

# Table 2-2 - Summary and Comparison of Land Allocations and Standards and Guidelines Among Alternatives

| | Alternative | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Congress. Reserve | million acres | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 | 6.983 |
| Late-Successional Reserves | million acres | 11.495 | 8.917 | 8.039 | 8.260 | 6.716 | 7.517 | 5.766 | 7.517 | 7.053 | 7.517 |
| | Timber harvest/salvage | None | Treatment of stands less than 50 years old. Very limited salvage | Same as Alternative 2 | Treatment of stands and salvage per Northern Spotted Owl Recovery Plan | Same as Alternative 4 | Same as Alternative 2 | Same as Alternative 4 | Treatment of stands in Murrelet Zone 1 up to 50 years. Other stands up to 180 years. | West - Treatment of less than 80 years old.<br>East - Manage to reduce risk of catastrophic loss. | Same as Alternative 2 |
| | Protection for sites occupied by marbled murrelets outside reserves | Yes | Yes | Yes | Yes | Yes | Yes | No | No | Yes | Yes |
| | Protection of SAT species closely associated with old-growth | Yes | No | Yes | Yes | Yes | No | No | No | Yes | No |
| Managed Late-Successional Areas or Adaptive Management Areas (Alt. 9 only) | million acres | 0 | 0 | 0.846 | 0.147 | 0.147 | 0 | 0.147 | 0 | 1.488 | 0 |
| | Timber harvest/salvage | N/A | N/A | West-Long rotation, 50 percent retention<br>East-Long rotation, or uneven-age management | Treatment of stands and salvage per Northern Spotted Owl Recovery Plan | Same as Alternative 4 | N/A | Same as Alternative 4 | N/A | Adaptive Management Areas (See Appendix B) | N/A |
| Administrative Withdrawn Areas | million acres | 1.081 | 1.517 | 1.685 | 1.660 | 2.078 | 1.834 | 2.286 | 1.834 | 1.653 | 1.834 |
| Riparian Reserves | million acres | 1.870 | 1.993 | 2.120 | 2.881 | 2.651 | 2.288 | 0.619 | 1.495 | 2.231 | 2.288 |
| | Buffer widths[1] | 2:1:1 | 2:1:1 in Aquatic conservation emphasis key watersheds, 2:1:$^1/_2$ other watersheds | Same as Alternative 2 | Same as Alternative 1 | Same as Alternative 2 | Same as Alternative 2 | Variable, usually no buffers on intermittent streams | 2:$^1/_2$:$^1/_6$ | Same as Alternative 2 | Same as Alternative 2 |
| Matrix | million acres | 2.831 | 4.851 | 4.587 | 4.330 | 5.686 | 5.638 | 8.460 | 6.431 | 4.853 | 5.638 |
| | 50-11-40 | Yes | Yes | Yes | Yes | Yes | Yes | Natl. Forest-Yes<br>BLM-modified | No | No | No |
| | Snags; Logs; Green trees per acre | 2:2:6 | 2:2:6 | Support 40% pop:<br>West - 12,<br>East 2-10:4 | Variable on National Forests.<br>BLM-2:2:6-9 | Same as Alternative 4 | 2:2:6 | Same as Alternative 4 | Same as Alternative 4 | Coastal areas WA/OR: 2:2:0<br>Other areas retention or long rotation. | 2:2:6 |

---

[1] Riparian Reserve Buffer Widths (e.g. 2:1:1), are expressed as multiples of the height of a maximum site-potential tree, measured on each side of fish bearing stream, non-fish bearing streams, and intermittent streams respectively (see text).

# Alternative 1 - 24,260,700 acres total Federal land

This alternative was designed to have the highest probability of meeting five biological criteria: (1) viability of spotted owls, (2) viability of marbled murrelets, (3) viability of fish species and stocks at risk, (4) viability of other species associated with old-growth forests, and (5) maintaining interactive late-successional forests on Federal lands. Essentially all old-growth forests would be protected, significant protection of forests adjacent to streams would be provided to protect fish, and some forest cover would be retained in areas where timber cutting is allowed, to permit spotted owl dispersal.

**Congressionally Reserved** - 6,983,100 acres

**Late-Successional Reserves** - 11,495,500 acres

> ELEMENTS: LS/OG1, spotted owl additions, LS/OG2, LS/OG3, occupied marbled murrelet sites, some protection buffers for other species (those specifying no harvest).
>
> STANDARDS AND GUIDELINES: No cutting of trees or salvage of dead trees.

**Riparian Reserves** - 1,870,200 acres

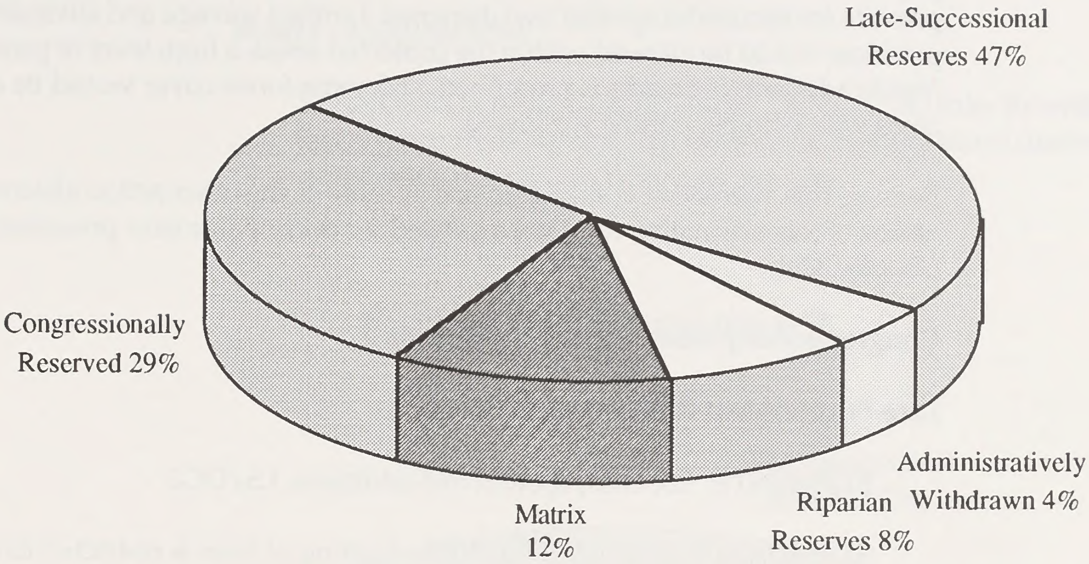
1. Fish-bearing streams, lakes, reservoirs - a buffer width on each side equal to two times the height of a site-potential tree or 300 feet (whichever is greater).
2. Permanently flowing nonfish-bearing streams, ponds, wetlands greater than 1 acre - a buffer width on each side equal to the height of one site-potential tree or 150 feet (whichever is greater).
3. Intermittent streams and wetlands less than 1 acre - a buffer width on each side equal to the height of one site-potential tree or 100 feet (whichever is greater).

**Administratively Withdrawn** - 1,081,200 acres

**Matrix** - 2,830,600 acres

> STANDARDS AND GUIDELINES: The 50-11-40 rule. Retention of at least six large, green trees per acre that exceed the average stand diameter, two large snags per acre, and two large logs per acre. At least 10 percent of the matrix should be over 180 years old at any one time. The remainder of the matrix is to be managed using area control to achieve a rotation of 180 years. Protection buffers for other species.

# Figure 2-4 Alternative 1



# Alternative 2 - 24,260,700 acres total Federal land

This alternative was designed to protect the ecologically significant old-growth forests and additional areas determined to be necessary for northern spotted owl population viability. Management of the intervening lands would be focused to provide for successful spotted owl dispersal. Limited salvage and silvicultural practices would be allowed within the protected areas, a high level of protection of forests adjacent to streams is prescribed, and some forest cover would be retained in areas where timber cutting is allowed.

Because this alternative is similar to one or more of the other action alternatives, the effects of this alternative were not analyzed for every parameter presented in Chapter 3&4.

**Congressionally Reserved** - 6,983,100 acres

**Late-Successional Reserves** - 8,917,400 acres

ELEMENTS: LS/OG1, spotted owl additions, LS/OG2

STANDARDS AND GUIDELINES: Cutting of trees is restricted to restoring late-successional forest attributes, primarily through precommercial and commercial thinning of forest stands less than 50 years old that have been established following logging. Harvest proposals would require review by an interagency oversight group. Salvage of dead trees would be limited to areas of catastrophic loss exceeding 100 acres under guidelines for salvage adapted from the *Final Draft Recovery Plan for the Northern Spotted Owl* (see Appendix B, Recovery Plan Standards and Guidelines).

**Other Late-Successional Reserves** -

ELEMENTS: Occupied marbled murrelet sites, some protection buffers for other species.

**Riparian Reserves** - 1,992,700 acres

1. Fish-bearing streams, lakes, reservoirs - a buffer width on each side equal to two times the height of a site-potential tree or 300 feet (whichever is greater).

2. Permanently flowing nonfish-bearing streams, ponds, wetlands greater than 1 acre - a buffer width on each side equal to the height of one site-potential tree or 150 feet (whichever is greater).

3a. Intermittent streams and wetlands less than 1 acre in Aquatic Conservation Emphasis Key Watersheds - a buffer width on each side equal to the height of one site-potential tree or 100 feet (whichever is greater).

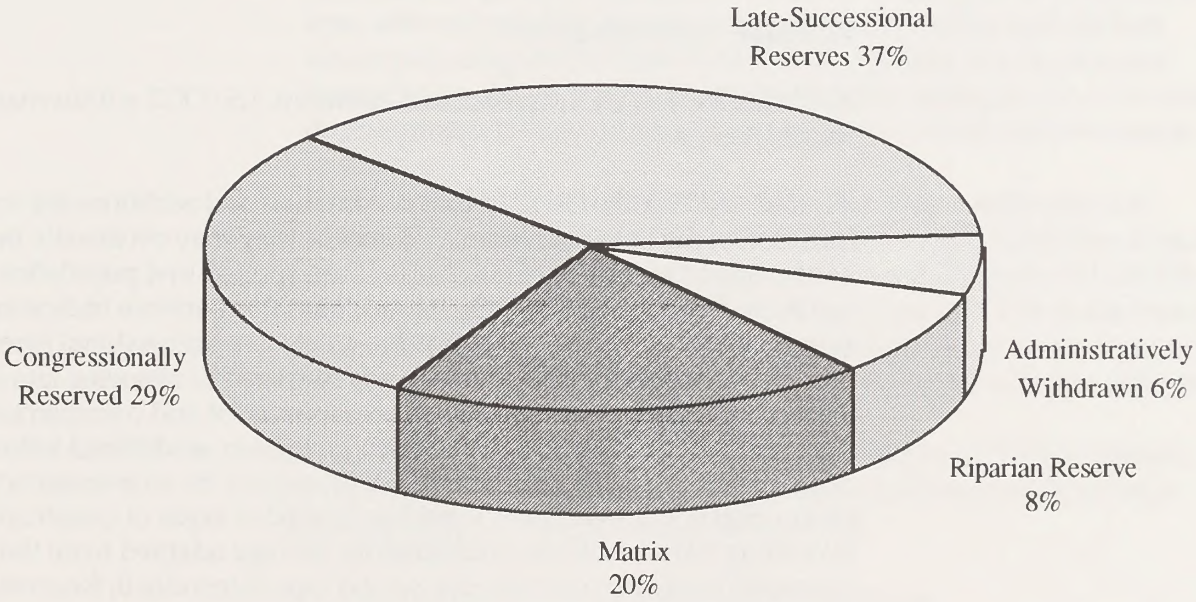
3b. Intermittent streams and wetlands less than 1 acre in all other watersheds - a buffer width on each side equal to one half the height of a site-potential tree or 50 feet (whichever is greater).

**Administratively Withdrawn** - 1,516,600 acres

**Matrix** - 4,850,900 acres

STANDARDS AND GUIDELINES: The 50-11-40 rule. Retention of at least six large, green trees per acre that exceed the average stand diameter, two large snags per acre, and two large logs per acre.

# Figure 2-5 Alternative 2



# Alternative 3 - 24,260,700 acres total Federal land

This alternative was designed to provide for intact late-successional forest ecosystems that are interconnected, while at the same time allowing for the production of forest products from some late-successional forests. Land allocations and management prescriptions would vary by physiographic province; the eastern Cascades in Oregon and Washington and the California Cascades would be treated differently than the other physiographic provinces.

"Eastside Cascades" includes the Eastern Cascades of Oregon and Washington and the California Cascades physiographic provinces (see Description of Physiographic Provinces in Chapter 3&4 of this Draft SEIS). "Westside" includes all other provinces.

**Congressionally Reserved** - 6,983,100 acres

**Late-Successional Reserves** - 8,039,200 acres

**Westside** - 6,081,400 acres

ELEMENTS: LS/OG1, spotted owl additions, LS/OG2 within marbled murrelet zone 1.

STANDARDS AND GUIDELINES: Although owl additions are initially included in the Late-Successional Reserves, they may eventually be reclassified as Managed Late-Successional Areas when spotted owl population persistence has been demonstrated and there is additional experience indicating that forest stands can be successfully managed to create late-successional forests. Cutting of trees in Late-Successional Reserves is restricted to restoring late-successional forest attributes, primarily through precommercial and commercial thinning of forest stands less than 50 years old that have been established following logging. Harvest proposals would require review by an interagency oversight group. Salvage of dead trees would be limited to areas of catastrophic loss exceeding 100 acres under guidelines for salvage adapted from the *Final Draft Recovery Plan for the Northern Spotted Owl* (see Appendix B, Recovery Plan Standards and Guidelines).

**Other Westside Late-Successional Reserves**

ELEMENTS: Occupied marbled murrelet sites, some protection buffers for other species.

**Eastside Cascades** - 1,957,800 acres

ELEMENT: LS/OG1

STANDARDS AND GUIDELINES: Follow provisions adapted from the *Final Draft Recovery Plan for the Northern Spotted Owl* for DCAs (Appendix B, Recovery Plan Standards and Guidelines). This allows treatment of forest stands to reduce risk of fire and insect infestations within an objective of providing late-successional forest conditions at landscape scales. The guidelines also address salvage.

**Other Eastside Late-Successional Reserves**

ELEMENT: Some protection buffers for other species.

**Managed Late-Successional Areas**

**Westside** - 846,400 acres

ELEMENT: LS/OG2 outside of marbled murrelet zone 1.

STANDARDS AND GUIDELINES: Silvicultural treatments will only be done within the constraints and objectives for Managed Late-Successional Areas noted under the land allocations section earlier in this chapter. Silvicultural treatments are further constrained as follows:

1. Retention (no cutting) of 50 percent of each LS/OG2 area. Selection of the forest stands to be retained would be based on occupancy by marbled murrelets or spotted owls, protection of fish-bearing streams within the area, sites occupied by other old-growth forest species, and the best developed old-growth forest stands. Thirty percent is to be selected immediately. An additional 20 percent of each cutting unit is to be identified during project layout, primarily for protection of intermittent streams.

2. Remaining area to be managed on 250-year rotation with area and inventory control, and cutting would proceed only if and when 40 percent of an entire LS/OG2 was in forest stands at least 100 years old (stands identified under 1. above contribute to this 40 percent if they are over 100 years old.). Retention of six of the largest and oldest green trees per acre on the actual cutting unit. These do not count towards the 20 percent retention.

Salvage is permitted within the area to be managed on 250-year rotation. Salvage consistent with the objectives for Late-Successional Reserves is permitted within the 50 percent to be reserved.

**Other Westside Managed Late-Successional Areas**

ELEMENT: Some protection buffers for other species.

**Eastside Cascades** - approximately 837,000 acres, included in late-succcessional reserve total. See footnote to Table III-5)

ELEMENTS: LS/OG2, owl additions, Managed Pair Areas for known and future owl pairs and resident singles from the Final Draft Recovery Plan.

STANDARDS AND GUIDELINES: Management of the managed pair areas is based on the provisions for such areas adapted from the *Final Draft of the Northern Spotted Owl Recovery Plan* (see Appendix B, Recovery Plan Standards and Guidelines). Management for the LS/OG2s and owl additions has the objective of providing old-growth characteristics. Silvicultural treatments are further constrained as follows:

1. Retention (no cutting) of 50 percent of each LS/OG2 and owl addition area. Selection of the retained stands would be based on occupancy by marbled murrelets (east of the crest of the Cascade Range in Washington) or spotted owls, protection of fish-bearing streams within the area, sites occupied by other old-growth forest species, and identification of the best developed old-growth forest stands. Thirty percent is to be selected immediately. An additional 20 percent of each cutting unit is to be identified from stands of late-successional forests (or the oldest available) left in configurations that will provide buffering of intermittent streams.

2. Manage remaining LS/OG2 and owl additions through either uneven-aged or even-aged timber management or a combination of the two, to reduce the risk of catastrophic fire and insect infestation. Cutting would proceed only if and when at least 40 percent of an entire LS/OG2 or owl addition was in forest stands at least 80 years old. For mixed-conifer even-age management, a rotation of 250 years would be used. For ponderosa pine or Jefferey pine areas, rotation would be 350 years. For other mesic series, rotation would be 200 years. For lodgepole pine, rotation would be 100 years. Retain six of the largest and oldest green trees per acre on the actual cutting unit. These do not count toward the 20 percent retention target. The goal of uneven-aged management would be to retain and grow large conifer trees.

Salvage is permitted within the area to be managed on 250-350 year rotations or with uneven-age management. Salvage consistent with the objectives of the Late-Successional Reserves is permitted within the 50 percent to be reserved.

**Other Eastside Cascades Managed Late-Successional Areas**

ELEMENT: Some protection buffers for other species.

**Riparian Reserves** - 2,120,400 acres

1 Fish-bearing streams, lakes, reservoirs - a buffer width on each side equal to two times the height of a site-potential tree or 300 feet (whichever is greater).

2. Permanently flowing nonfish-bearing streams, ponds, wetlands greater than 1 acre - a buffer width on each side equal to the height of one site-potential tree or 150 feet (whichever is greater).

3a. Intermittent streams and wetlands less than 1 acre in Aquatic Conservation Emphasis Key Watersheds - a buffer width on each side equal to the height of one site-potential tree or 100 feet (whichever is greater).

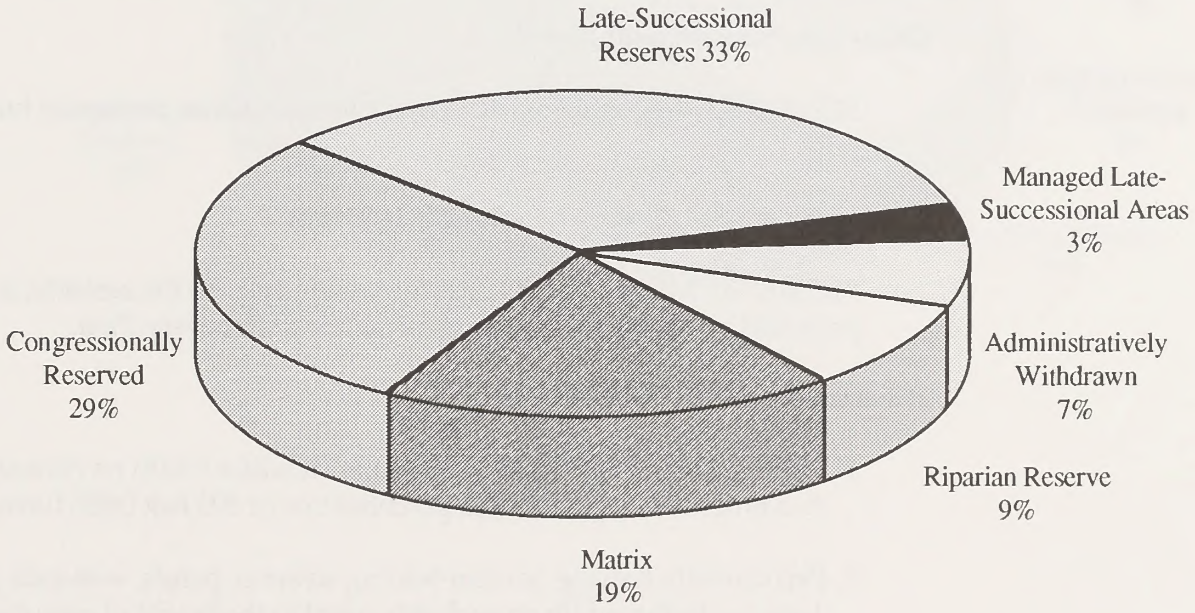
3b. Intermittent streams and wetlands less than 1 acre in all other watersheds - a buffer width on each side equal to one half the height of a site-potential tree or 50 feet (whichever is greater).

**Administratively Withdrawn** - 1,684,600 acres

**Matrix** - 4,587,000 acres

STANDARDS AND GUIDELINES: The 50-11-40 rule. Retention of 10 percent of the matrix area in late-successional forest stands (or the oldest available) in 5-10 acre well-dispersed islands. Riparian buffers and 10 percent retention counts toward 50-11-40. On cutting units, retain four large green trees per acre, 12 large logs in decay class 1 and 2 (2 to 10 logs in the eastern physiographic provinces), and all logs that are in decay classes 3, 4, and 5. Retain enough snags to support populations of cavity nesters at 40 percent of potential population levels (Neitro et al. 1985, as presented in Brown et al. 1985). Protection buffers for other species.

**Figure 2-6 Alternative 3**



# Alternative 4 - 24,260,700 acres total Federal land

This alternative was designed to protect the most ecologically significant late-successional forests and additional areas identified to protect spotted owls. It would maximize protection of forests adjacent to streams in order to protect fish, and would provide for the retention of some forest cover in areas where timber cutting is allowed.

**Congressionally Reserved** - 6,983,100 acres

**Late-Successional Reserves** - 8,259,700 acres

ELEMENTS: Designated Conservation Areas, Reserved Pair Areas, and Residual Pair Areas from the Final Draft Recovery Plan, LS/OG1, LS/OG2 within marbled murrelet zone 1.

STANDARDS AND GUIDELINES: Cutting of trees, including salvage, would be limited by provisions adapted from the Final Draft Recovery Plan for DCAs (see Appendix B, Recovery Plan Standards and Guidelines).

**Other Late-Successional Reserves**

ELEMENTS: Occupied marbled murrelet sites, some protection buffers for other species.

**Managed Late-Successional Areas** - 147,000 acres

ELEMENT: Managed Pair Areas for known and, on the eastside, future, owl pairs and resident singles from the Final Draft Recovery Plan.

**Riparian Reserves** - 2,880,800 acres

1. Fish-bearing streams, lakes, reservoirs - a buffer width on each side equal to two times the height of a site-potential tree or 300 feet (whichever is greater).

2. Permanently flowing nonfish-bearing streams, ponds, wetlands greater than 1 acre - a buffer width on each side equal to the height of one site-potential tree or 150 feet (whichever is greater).

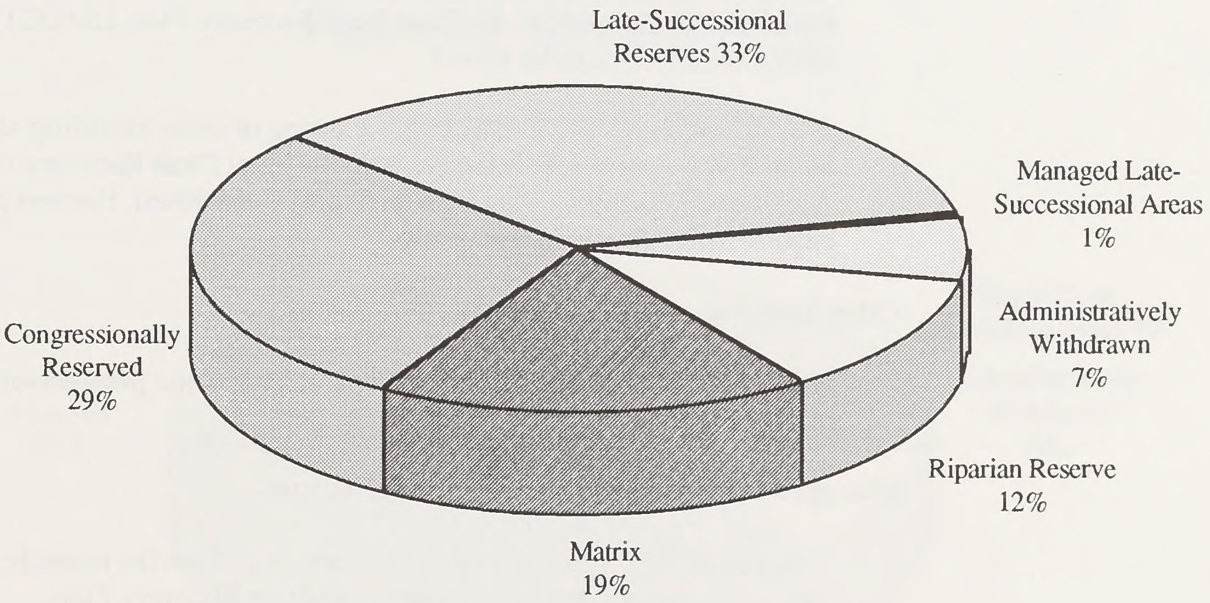
3. Intermittent streams and wetlands less than 1 acre - a buffer width on each side equal to the height of one site-potential tree or 100 feet (whichever is greater).

**Administratively Withdrawn** - 1,659,900 acres

**Matrix** - 4,330,200 acres

STANDARDS AND GUIDELINES: The 50-11-40 rule. Retention of green trees, snags, and coarse woody debris at levels specified in the current plans and draft plan preferred alternatives. Retention of additional snags is required in the Eastern Oregon and Washington Cascades and the Oregon and California Klamath Physiographic Provinces or specified by Thomas et al. (1993). Protection buffers for other species.

Figure 2-7 Alternative 4



## Alternative 5 - 24,260,700 acres total Federal land

This alternative was designed to implement the mitigation strategy recommended in the Scientific Analysis Team report. It adds riparian buffers, marbled murrelet protection, and endemic species protection to the *Final Draft of the Northern Spotted Owl Recovery Plan* and current plans and draft plan preferred alternatives.

**Congressionally Reserved** - 6,983,100 acres

**Late-Successional Reserves** - 6,715,600 acres

ELEMENTS: Designated Conservation Areas, Reserved Pair Areas, and Residual Pair Areas from the Final Draft Recovery Plan, LS/OG1 and LS/OG2 within marbled murrelet zone 1.

STANDARDS AND GUIDELINES: Cutting of trees, including salvage, would be limited by provisions adapted from the Final Draft Recovery Plan (see Appendix B, Recovery Plan Standards and Guidelines). Harvest proposals require review by oversight group

**Other Late-Successional Reserves**

ELEMENTS: Occupied marbled murrelet sites, some protection buffers for other species.

**Managed Late-Successional Areas** - 147,000 acres

ELEMENT: Managed Pair Areas for known and, on the eastside, future, owl pairs and resident singles from the Final Draft Recovery Plan.

**Riparian Reserves** - 2,651,300 acres

1. Fish-bearing streams, lakes, reservoirs - a buffer width on each side equal to two times the height of a site-potential trees or 300 feet (whichever is greater).

2. Permanently flowing nonfish-bearing streams, ponds, wetlands greater than 1 acre - a buffer width on each side equal to the height of one site-potential tree or 150 feet (whichever is greater).

3a. Intermittent streams and wetlands less than 1 acre in Aquatic Conservation Emphasis Key Watersheds - a buffer width on each side equal to the height of one site-potential tree or 100 feet (whichever is greater).

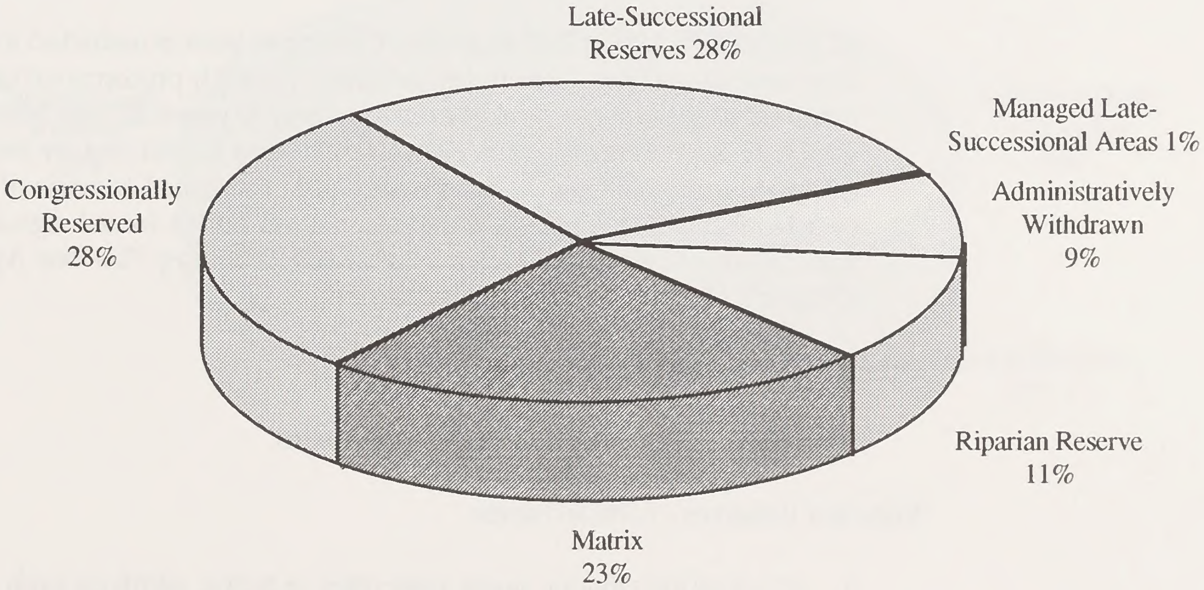
3b. Intermittent streams and wetlands less than 1 acre in all other watersheds - a buffer width on each side equal to one half the height of a site-potential tree or 50 feet (whichever is greater).

**Administratively Withdrawn** - 2,078,200 acres

**Matrix** - 5,685,700 acres

STANDARDS AND GUIDELINES: The 50-11-40 rule. Retention of green trees, snags, and coarse woody debris at levels specified in current plans and draft plan preferred alternatives. Retention of additional snags is required in the Eastern Oregon and Washington Cascades and the Oregon and California Klamath Physiographic Provinces or specified by Thomas et al. (1993). Protection buffers for other species.

Figure 2-8 Alternative 5



## Alternative 6 - 24,260,700 acres total Federal land

This alternative was designed to protect the most ecologically significant late-successional forests and additional areas determined to be necessary for spotted owl population viability from the Scientific Panel on Late-Successional Forest Ecosystems.

Because this alternative is similar to one or more of the other action alternatives, the effects of this alternative were not analyzed for every parameter presented in Chapter 3&4.

**Congressionally Reserved** - 6,983,100 acres

**Late-Successional Reserves** - 7,517,400 acres

ELEMENTS: LS/OG1, spotted owl additions, LS/OG2 within marbled murrelet zone 1.

STANDARDS AND GUIDELINES: Cutting of trees is restricted to restoring late-successional forest attributes, primarily through precommercial and commercial thinning of forest stands less than 50 years old that have been established following logging. Harvest proposals would require review by an oversight group. Salvage of dead trees would be limited to areas of catastrophic loss exceeding 100 acres under guidelines for salvage adapted from the *Final Draft of the Northern Spotted Owl Recovery Plan* (see Appendix B, Recovery Plan Standards and Guidelines).

**Other Late-Successional Reserves**

ELEMENT: Occupied marbled murrelet sites.

**Riparian Reserves** - 2,288,400 acres

1. Fish-bearing streams, lakes, reservoirs - a buffer width on each side equal to two times the height of a site-potential tree or 300 feet (whichever is greater).

2. Permanently flowing nonfish-bearing streams, ponds, wetlands greater than 1 acre - a buffer width on each side equal to the height of one site-potential tree or 150 feet (whichever is greater).

3a. Intermittent streams and wetlands less than 1 acre in Aquatic Conservation Emphasis Key Watersheds - a buffer width on each side equal to the height of one site-potential tree or 100 feet (whichever is greater).

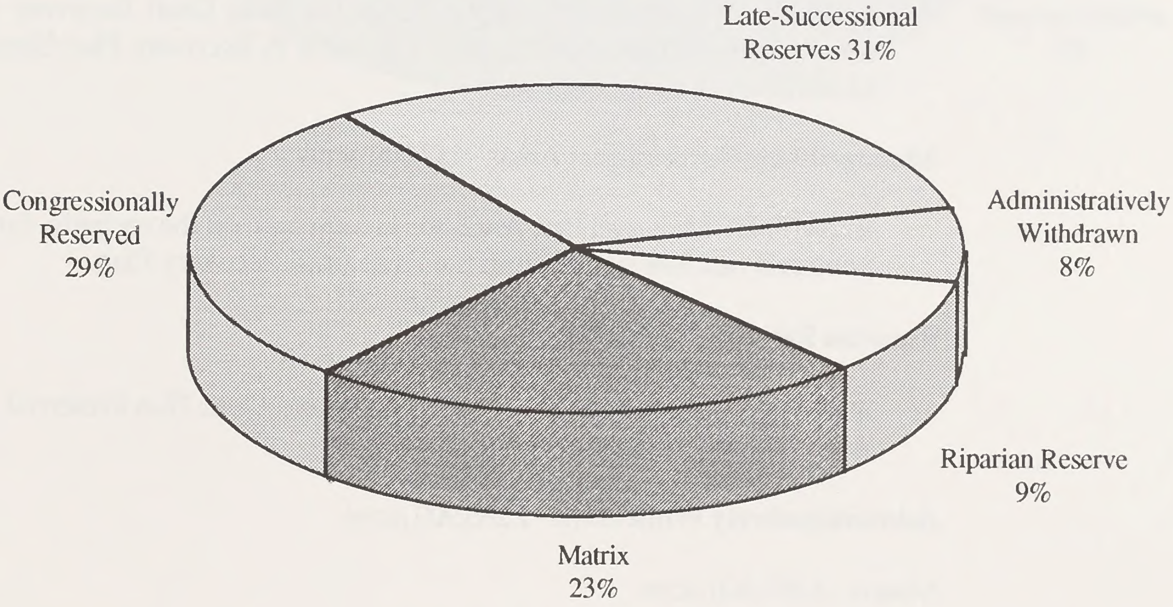
3b. Intermittent streams and wetlands less than 1 acre in all other watersheds - a buffer width on each side equal to one half the height of a site-potential tree or 50 feet (whichever is greater).

**Administratively Withdrawn** - 1,833,800 acres

**Matrix** - 5,638,000 acres

STANDARDS AND GUIDELINES: The 50-11-40 rule. Retention of at least six large, green trees per acre that exceed the average stand diameter, two large snags per acre, and two large logs per acre.

# Figure 2-9 Alternative 6



# Alternative 7 - 24,260,700 acres total Federal land

This alternative is intended to reflect the most likely management direction that would have been implemented if the Forest Service and BLM had continued their present land and resource management planning processes and if they were to adopt the elements of the *Final Draft of the Northern Spotted Owl Recovery Plan.*

**Congressionally Reserved** - 6,983,200 acres

**Late-Successional Reserves** - 5,765,600 acres

ELEMENTS: Designated Conservation Areas, Reserved Pair Areas, and Residual Pair Areas from the Final Draft Recovery Plan.

STANDARDS AND GUIDELINES: Cutting of trees, including salvage, would be limited by provisions adapted from the Final Draft Recovery Plan as interpreted by Federal agencies (see Appendix B, Recovery Plan Standards and Guidelines).

**Managed Late-Successional Areas** - 147,000 acres

ELEMENT: Managed Pair Areas for known and, on the eastside, future, owl pairs and resident singles from the Final Draft Recovery Plan.

**Riparian Reserves** - 619,400 acres

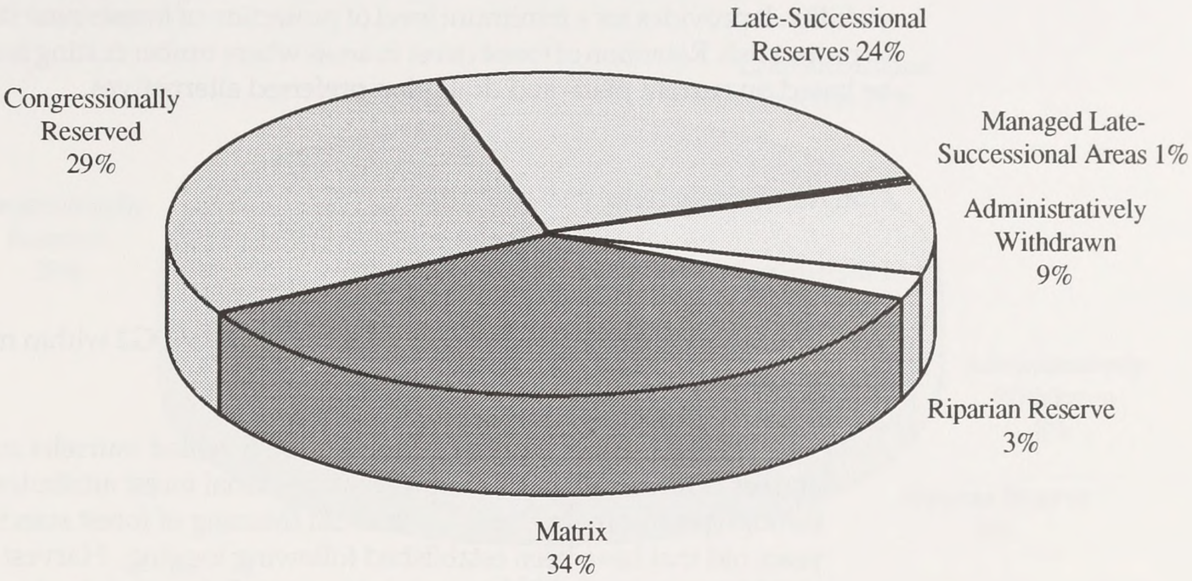
Standards and guidelines of Current Plans and Draft Plan Preferred Alternatives (see introduction).

**Administratively Withdrawn** - 2,285,900 acres

**Matrix** - 8,459,800 acres

STANDARDS AND GUIDELINES: The 50-11-40 rule, which on lands administered by the BLM would be modified so as to be met by connectivity blocks. Retention of green trees, snags, and coarse woody debris at levels specified in the current plans and draft plan preferred alternatives.

# Figure 2-10 Alternative 7



# Alternative 8 - 24,260,700 acres total Federal land

This alternative is designed to protect the most ecologically significant late-successional forests and additional areas determined to be necessary for spotted owl population viability. It provides for a minimum level of protection of forests near streams in order to protect fish. Retention of forest cover in areas where timber cutting is allowed would be based on current plans and draft plan preferred alternatives.

**Congressionally Reserved** - 6,983,100 acres

**Late-Successional Reserves** - 7,517,400 acres

ELEMENTS: LS/OG1, spotted owl additions, LS/OG2 within marbled murrelet zone 1.

STANDARDS AND GUIDELINES: Within marbled murrelet zone 1, cutting of trees is restricted to restoring late-successional forest attributes, primarily through precommercial and commercial thinning of forest stands less than 50 years old that have been established following logging. Harvest proposals would require review by an oversight group. Salvage of dead trees would be limited to areas of catastrophic loss exceeding 100 acres under guidelines for salvage adapted from the *Final Draft of the Northern Spotted Owl Recovery Plan* (see Appendix B, Recovery Plan Standards and Guidelines).

Outside of marbled murrelet zone 1, cutting of trees is permitted in forest stands less than 180 years of age to produce or maintain spotted owl habitat. Salvage of dead trees would be permitted provided that Forest Plan standards for snags and logs were met after logging.

**Riparian Reserves** - 1,495,300 acres

1. Fish-bearing streams, lakes, reservoirs - a buffer width on each side equal to two times the height of a site-potential trees or 300 feet (whichever is greater).

2. Permanently flowing nonfish-bearing streams, ponds, wetlands greater than 1 acre - a buffer width equal to one half the height of a site-potential tree or 75 feet (whichever is greater).

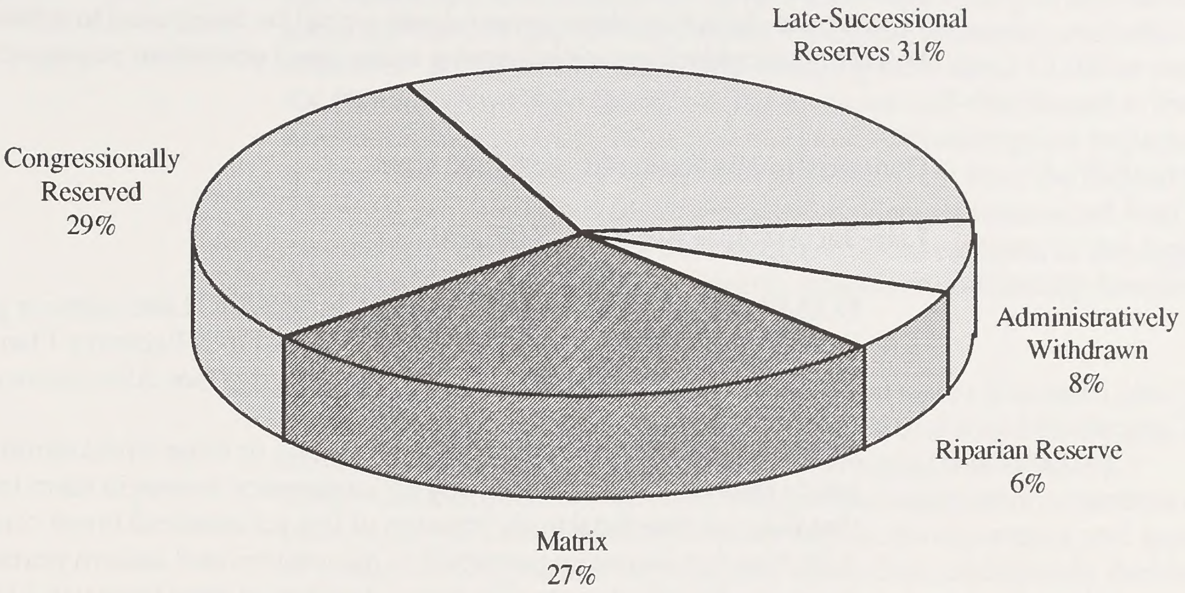
3. Intermittent streams and wetlands less than 1 acre - a buffer width equal to one sixth the height of a site-potential tree or 25 feet (whichever is greater).

**Administratively Withdrawn** - 1,833,800 acres

**Matrix** - 6,431,100 acres

STANDARDS AND GUIDELINES: Retention of green trees , snags, and coarse woody debris at levels specified in the current plans and draft plan preferred alternatives.

# Figure 2-11 Alternative 8



# Alternative 9 the Preferred Alternative

## - 24,260,700 acres total Federal land

This alternative blends a number of recommendations from the four previous efforts to develop the strategy for manangement of old-growth forests. Old-growth forests and other habitat would be protected where they overlap with Key Watersheds. Adaptive Management Areas would be designated to achieve social and economic objectives while learning more about ecosystem management.

**Congressionally Reserved** - 6,983,100 acres

**Late-Successional Reserves** - 7,052,600

ELEMENTS: Some or parts of LS/OG1 and LS/OG2 and some or parts of the Designated Conservation Areas from the Final Draft Recovery Plan in the western portion of the northern spotted owl range (see Alternative map).

STANDARDS AND GUIDELINES: Thinning or other silvicultural treatments inside reserves requires review by an interagency oversight team to ensure that they are beneficial to the creation of late-successional forest conditions. Activities that would be permitted in the western and eastern portions of the range are described separately below. Salvage of dead trees would be based on guidelines adapted from the *Final Draft of the Northern Spotted Owl Recovery Plan* (see Appendix B, Recovery Plan Standards and Guidelines) and would be limited to areas where catastrophic loss exceeded 10 acres.

### West of the Cascades

There is no entry allowed in stands older than 80 years of age. Thinnings (pre-commercial and commercial) may occur in stands up to 80 years of age regardless of the origin of the stands (plantations planted after logging or stands naturally regenerated after fire or blowdown). The purpose of these silvicultural treatments is to be neutral or beneficial to the creation and maintenance of late-successional forest conditions.

### East of the Cascades and the Eastern Portion of the Klamath Province

Given the increased risk of fire in these areas due to more low moisture conditions and the rapid accumulation of fuels as the aftermath of insect outbreaks and drought, there are additional management activities allowed in Late-Successional Reserves. Guidelines to reduce risks to large-scale disturbance are adapted from the *Final Draft of the Northern Spotted Owl Recovery Plan* (see Appendix B, Recovery Plan Standards and Guidelines).

### Other Late-Successional Reserves

ELEMENTS: Occupied marbled murrelet sites, some protection buffers for other species.

## Adaptive Management Areas - 1,487,700 acres

Standards and Guidelines

Adaptive Management Areas are landscape units identified in Alternative 9 and designated to encourage the development and testing of technical and social approaches to achieving desired ecological, economic, and other social objectives. Ten areas of Federal lands ranging from about 84,000 to nearly 400,000 acres have been identified. The areas are well-distributed in the physiographic provinces. Most are associated with subregions impacted socially and economically by reduced timber harvest from the Federal lands. The areas provide a diversity of biological challenges, intermixed land ownerships, natural resource objectives, and social contexts. In the Applegate Adaptive Management Area in Oregon, grassroots community-based activities have already begun.

The overall objective for Adaptive Management Areas is to learn how to mange the ecosystem in terms of both technical and social challenges, and in a manner consistent with applicable laws. It is hoped that localized, idiosyncratic approaches that may achieve the conservation objectives of this plan can be pursued. These approaches rely on the experience and ingenuity of resource managers and communities rather than traditionally derived and tightly prescriptive approaches that are generally applied in managing the forests.

The primary social objective of Adaptive Management Areas is the provision of flexible experimentation with policies and management. These areas should provide opportunities for land managing and regulatory agencies, other government entities, nongovernmental organizations, local groups, land owners, communities, and citizens to work together to develop innovative management approaches. Broadly, Adaptive Management Areas are intended to be prototypes of how forest communities might be sustained. For more information, see Appendix B, Adaptive Management Areas.

## Riparian Reserves - 2,231,300 acres

1. Fish-bearing streams, lakes, reservoirs - a buffer width on each side equal to two times the height of a site-potential tree or 300 feet (whichever is greater).

2. Permanently flowing nonfish-bearing streams, ponds, wetlands greater than 1 acre - a buffer width on each side equal to the height of one site-potential tree or 150 feet (whichever is greater).

3a. Intermittent streams and wetlands less than 1 acre in Aquatic Conservation Emphasis Key Watersheds - a buffer width on each side equal to the height of one site-potential tree or 100 feet (whichever is greater).

3b. Intermittent streams and wetlands less than 1 acre in all other watersheds - a buffer width on each side equal to one half the height of a site-potential tree or 50 feet (whichever is grater).

**Administratively Withdrawn -** 1,652,900 acres

**Matrix -** 4,853,300 acres

STANDARDS AND GUIDELINES: For National Forests in the Oregon Coast Range Physiographic Province, the Olympic National Forest, and the Mt. Baker-Snoqualmie National Forest (areas with high stream density), management of the matrix is based on provisions of current plans and draft plan preferred alternatives for the retention of snags, logs, and green trees in cutting units.

For the remainder of the National Forests in Oregon and Washington, retain 15 percent of the area of each cutting unit. At least half of the 15 percent is to be left in small (1/2 to 4 acre) patches of intact late-successional forest or the next oldest stand available. The remaining half is to be left in green trees dispersed throughout the unit.

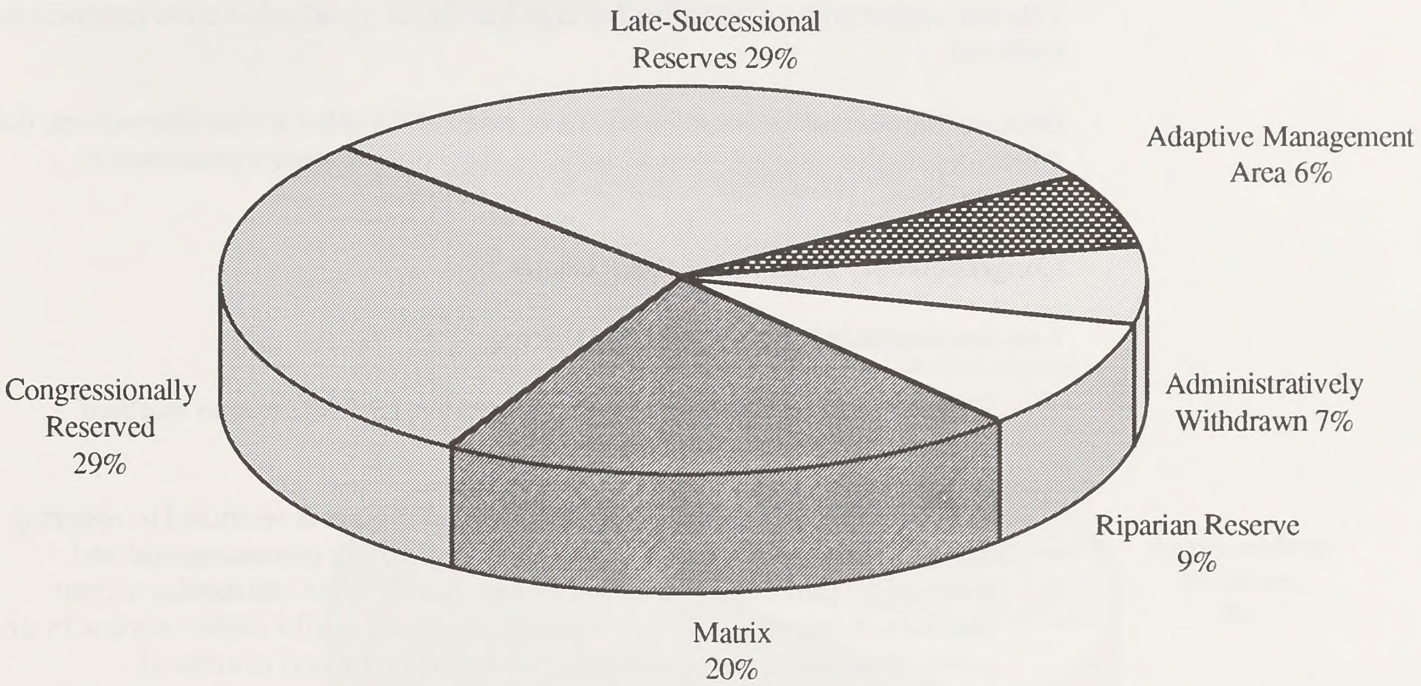
For lands administered by the BLM in Oregon north of Grants Pass (see Appendix B, Grants Pass Line), provide 640-acre blocks (Connectivity-Diversity Blocks) at 3 to 5 mile spacing that are managed on 150-year rotation. When an area is cut 12 to 18 green trees per acre will be retained. Twenty-five to 30 percent of each block must be in late-successional forest at any point in time. In the remainder of the matrix (General Forest Management Area), retain 6 to 8 green trees per acre. (See Appendix B, Revised Preferred Alternative.)

For lands administered by the BLM in Oregon south of Grants Pass, retain 16 to 25 large green trees per acre in harvest units.

For Federal lands in California, manage using area control to achieve 180-year rotations in conifer stands, 100-year rotations in hardwood stands, and retain 15 percent of the volume on each cutting unit.

Protection buffers for other species.

# Figure 2-12 Alternative 9



## The Preferred Alternative

Alternative 9 is the preferred alternative for this Draft SEIS. It is the alternative that most closely offers the specific management direction that would put into effect the plan that President Clinton announced on July 1, 1993, titled "The Forest Plan: For a Sustainable Economy and a Sustainable Environment".

# Alternative 10 - 24,260,700 acres total Federal land

This alternative is designed to protect the most ecologically significant late-successional forests and additional areas determined to be necessary for northern spotted owl population viability. Retention of forest cover in areas where timber cutting is allowed is described in current plans and draft plan preferred alternatives. This alternative is like Alternative 6 except that the 50-11-40 rule for the matrix is not included.

Because this alternative is similar to one or more of the other action alternatives, the effects of this alternative were not analyzed for every parameter presented in Chapter 3&4.

**Congressionally Reserved** - 6,983,100 acres

**Late-Successional Reserves -** 7,517,400 acres

ELEMENTS: LS/OG1, spotted owl additions, LS/OG2 within marbled murrelet zone 1.

STANDARDS AND GUIDELINES: Cutting of trees is restricted to restoring late-successional forest attributes, primarily through precommercial and commercial thinning of forest stands less than 50 years old that have been established following logging. Harvest proposals would require review by an oversight group. Salvage of dead trees would be limited to areas of catastrophic loss exceeding 100 acres under guidelines for salvage from the *Final Draft of the Northern Spotted Owl Recovery Plan* (see Appendix B, Recovery Plan Standards and Guidelines).

**Other Late-Successional Reserves -**

ELEMENT: Occupied marbled murrelet sites.

**Riparian Reserves** - 2,288,400 acres

1. Fish-bearing streams, lakes, reservoirs - a buffer width on each side equal to two times the height of a site-potential tree or 300 feet (whichever is greater).

2. Permanently flowing nonfish-bearing streams, ponds, wetlands greater than 1 acre - a buffer width on each side equal to the height of one site-potential tree or 150 feet (whichever is greater).

3a. Intermittent streams and wetlands less than 1 acre in Aquatic Conservation Emphasis Key Watersheds - a buffer width on each side equal to the height of one site-potential tree or 100 feet (whichever is greater).

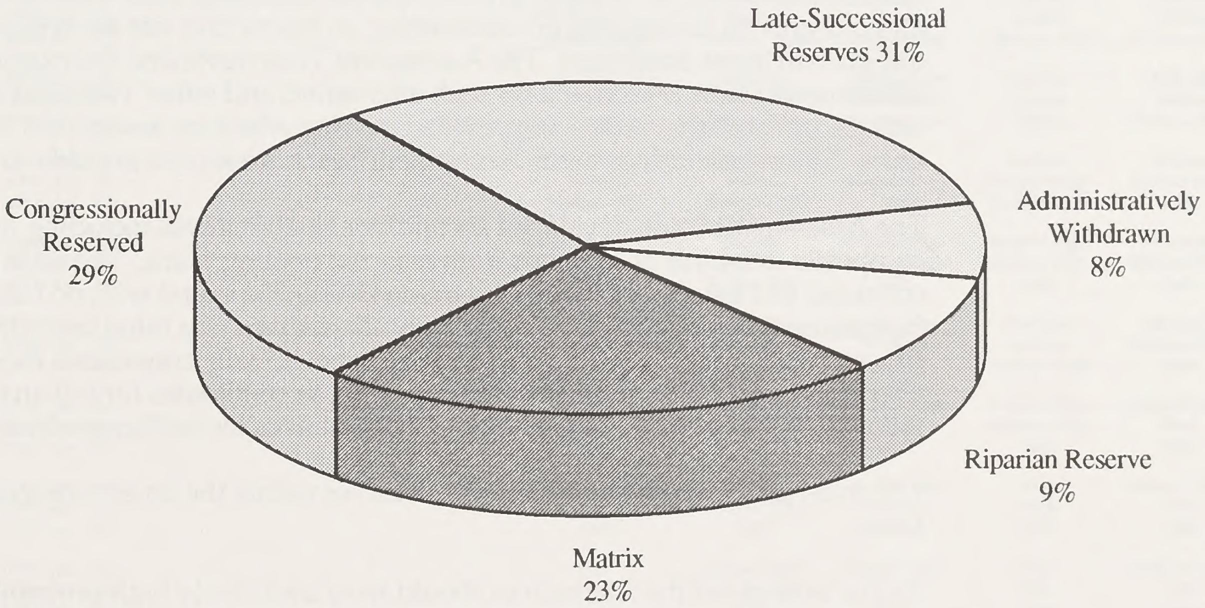
3b. Intermittent streams and wetlands less than 1 acre in all other watersheds - a buffer width on each side equal to one half the height of a site-potential tree or 50 feet (whichever is greater).

**Administratively Withdrawn -** 1,833,800 acres

**Matrix -** 5,638,000 acres

STANDARDS AND GUIDELINES: Retention of at least six large, green trees per acre that exceed the average stand diameter, two large snags per acre, and two large logs per acre.

# Figure 2-13 Alternative 10



# ALTERNATIVES ELIMINATED FROM DETAILED STUDY

The objectives of providing for late-successional and old-growth forest related species and minimizing adverse economic effects substantially limited the range of reasonable alternatives available for analysis. Within these limitations, the Assessment Team considered all recent proposed, published strategies for management of northern spotted owl habitat or management of late-successional and old-growth ecosystems as potential alternatives. Forty eight such plans were considered that represent a full range of alternatives (see Table III-1).

The Assessment Team considered each of these existing plans for inclusion as alternatives based on five criteria developed from the objectives expressed in the letter of instruction to the team from the White House. These criteria are consistent with the purpose and need for this Draft SEIS. The five criteria were: (1) viability of northern spotted owls, (2) viability of marbled murrelets, (3) viability of at-risk fish species and stocks, (4) viability of other species associated with late-successional and old-growth forests, and (5) maintaining an interacting late-successional and old-growth forest ecosystem. The Assessment Team reviewed the existing assessments of the five criteria for each alternative, and either validated existing ratings, updated the ratings, or provided a rating where no assessment had been done. The coarse ratings of the Assessment Team are shown in Table III-1.

The Assessment Team developed six additional alternatives including five composite mixtures of elements from assorted existing plans. The sixth alternative consisted of a long timber harvest rotation (300 to 350 years) with no Late-Successional Reserves. Each of these new alternatives was rated using the same process described above. The Assessment Team initially considered these six alternatives, and 29 of the existing alternatives, as candidates for full analysis. The following criteria were used to select the alternatives for further analysis.

1. It must be feasible to analyze the alternatives within the timeframe available to the team.

2. The majority of the alternatives should have a relatively high probability of successfully meeting the objectives for each of the five biological criteria.

3. At least one of the alternatives must have a medium probability rating.

4. At least one of the alternatives must have a very high probability rating.

5. Alternatives selected should include at least one developed from an approach focusing on species and at least one developed from an approach focusing on late-successional and old-growth forest stands.

6. The economic and social implications of the alternatives should be considered.

Eventually eight alternatives were selected for full analysis, the others either did not meet one or more of the criteria, or were within the range of those included. These eight met the five biological criteria and represented a range of estimated viability ratings and social and economic values. Additional adjustments were made to some of the alternatives during evaluation by the Assessment Team. Of the eight alternatives initially selected for full analysis, one was dropped. Three other alternatives were added resulting in a total of 10 alternatives.

**Table III-1.** Existing options considered with the Forest Ecosystem Management Assessment Team ratings for the five biological criteria.

| Option or plan | Rating for spotted owls | Rating for marbled murrelets | Rating for at-risk fish stocks | Rating for other species closely associated with old-growth forests | Rating for providing interacting old-growth forest ecosystem |
|---|---|---|---|---|---|
| 1. Regional guide interim direction (USDA 1984) | Low | Low | Low | Low | Low |
| 2. 1000 Acre spotted owl habitat area network (USDA 1988) | Low | Low | Low | Low | Low |
| 3. Spotted owl habitat network of varying sized reserves 1000-3000 acres (USDA 1988) | Medium | Low | Low | Low | Low |
| 4. Spotted owl habitat network of 2500-4500 acre reserves (USDA 1988) | Low-Medium Low | Low | Low | Low | Low |
| 5. BLM management framework plans and ODF&W agreement areas (USDA 1988) | Low | Low | Low | Low | Low |
| 6. Forest plans | Low | Low | Low | Low | Low |
| 7. Interagency Scientific Committee's conservation strategy (Thomas et al. 1990) | High | Medium-Low | Low | Medium-Low | Medium-Low |
| 8. Jamison strategy (USDI 1990) | Medium | Low | Low | Low-Medium Low | Low-Medium Low |
| 9. Johnson et al. (1991) Alt. 5A | Medium | Medium | Low | Medium | Medium |
| 10. Johnson et al. (1991) Alt. 5B | Medium | Medium | Low | Medium | Medium |
| 11. Johnson et al. (1991) Alt. 5C | Medium High | Medium High | Medium Low | Medium High | Medium High |
| 12. Johnson et al. (1991) Alt. 6A | High | Medium | Medium-Low | Medium | Medium |
| 13. Johnson et al. (1991) Alt. 6B | High | Medium | Medium Low | Medium | Medium |
| 14. Johnson et al. (1991) Alt. 6C | High | Medium High | Medium Low | Medium | Medium High |
| 15. Johnson et al. (1991) Alt. 7A | Medium | Medium | Medium | Medium | Medium |
| 16. Johnson et al. (1991) Alt. 7B | Medium | Medium | Medium-High | Medium High | Medium High |
| 17. Johnson et al. (1991) Alt. 7C | Medium High | Medium High | High | Medium High | High |
| 18. Johnson et al. (1991) Alt. 8A | High | Medium | Medium High | Medium High | Medium |
| 19. Johnson et al. (1991) Alt. 8B | High | Medium | Medium High | Medium High | Medium High |
| 20. Johnson et al. (1991) Alt. 8C | High | Medium High | High | High | High |
| 21. Johnson et al. (1991) Alt. 9A | High | Medium | Medium Low | Medium | Medium |
| 22. Johnson et al. (1991) Alt. 9B | High | Medium | Medium | Medium | Medium High |
| 23. Johnson et al. (1991) Alt. 9C | High | Medium High | Medium | Medium High | High |
| 24. Johnson et al. (1991) Alt. 10A | High | Medium | Medium High | Medium High | Medium High |
| 25. Johnson et al. (1991) Alt. 10B | High | Medium | High | Medium High | High |
| 26. Johnson et al. (1991) Alt. 10C | High | Medium High | High | High | High |
| 27. Johnson et al. (1991) Alt. 11A | High | Medium High | Medium Low | High | Medium High |
| 28. Johnson et al. (1991) Alt. 11B | High | Medium High | Medium | High | High |
| 29. Johnson et al. (1991) Alt. 11C | High | High | Medium | High | High |
| 30. Johnson et al. (1991) Alt. 12A | High | Medium High | Medium High | High | Medium High |
| 31. Johnson et al. (1991) Alt. 12B | High | Medium High | High | High | High |
| 32. Johnson et al. (1991) Alt. 12C | High | High | High | High | High |
| 33. Johnson et al. (1991) Alt. 13A | High | High | Medium Low | High | Medium High |
| 34. Johnson et al. (1991) Alt. 13B | High | High | Medium | High | High |
| 35. Johnson et al. (1991) Alt. 13C | High | High | Medium | High | High |
| 36. Johnson et al. (1991) Alt. 14A | High | High | High | High | High |
| 37. Johnson et al. (1991) Alt. 14B | High | High | High | High | High |
| 38. Johnson et al. (1991) Alt. 14C | High | High | High | High | High |
| 39. The multi-resource strategy (National Forest Products Assn. 1991) | Low | Low | Low | Low | Low |
| 40. ISC strategy plus critical habitat units (USDA 1992) | High | Medium | Low | Medium Low | Medium Low |
| 41. Preservation plan for the northern spotted owl (Lujan et al. 1992) | Low | Low | Low | Low | Low |
| 42. BLM preferred alternative DRMPs (USDI 1992a) | Medium | Medium Low | Medium Low | Medium | Medium |
| 43. California spotted owl plan (Verner et al. 1992) | Low | Low | Low-Medium Low | Medium Low | Medium Low |
| 44. Final Draft Recovery Plan Northern Spotted Owl (USDI 1992c) | High | Medium | Low-Medium | Medium Low | Medium Low |
| 45. Scientific Analysis Team Plan (Thomas et al. 1993) | High | High | High | High | Medium High |
| 46. New BLM preferred alternative (USDI 1993) | Medium High | Medium High | Medium High | Medium - Medium High | Medium |
| 47. Reed Noss Plan (Noss 1992) | Not rated because believed to be similar to Alt. 14c in Johnson et. al. (1991) | | | | |
| 48. No cutting on federal lands | High | High | High | High | High |

# COMPARISON OF THE EFFECTS OF THE ALTERNATIVES

## No-Action Alternative

The following discussion is designed to help the reader understand and compare the effects of the No-Action Alternative to the action alternatives. A full discussion of the No-Action Alternative is not necessary because it does not constitute a reasonable alternative (see Appendix C, Letter from Council of Environmental Quality).

The effects of the action alternatives on late-successional and old-growth forest ecosystems, old-growth related species, and old-growth related threatened and endangered species has been analyzed by the Assessment Team and is presented in Chapter 3 & 4. The No-Action Alternative has been analyzed in *A Conservation Strategy for the Northern Spotted Owl* (Thomas et al. 1990), in the *Alternatives for Management of Late-Successional Forests of the Pacific Northwest* (Johnson et al. 1991), and in the *Viability Assessments and Management Considerations for Species Associated with Late-Successional and Old-Growth Forests of the Pacific Northwest* (Thomas et al. 1993). These analyses determined that the management strategy of the No-Action Alternative would not maintain populations of old-growth forest related species.

The effects of the action alternatives on timber harvest levels and on regional economics and communities has been analyzed by the Assessment Team and is presented in the Economy and Communities section of Chapter 3 & 4. The Chapter 3 & 4 discussion and comparisons of the alternatives include historic harvest levels and employment of the 1980's along with projected levels that would occur if the various alternatives were implemented. Although specific information on the No-Action Alternative is not presented, the timber harvest level, employment, and revenues of the No-Action Alternative would be somewhat similar to those of the 1980's. Therefore, an approximate comparison of the effects of the No-Action Alternative with the action alternatives can be made by the use of the historic comparisons.

Notwithstanding that the historic information provides a point of comparison, the No-Action Alternative does not constitute a reasonable alternative because it would not meet the purpose and need of this SEIS (Chapter 1), the requirements of the Endangered Species Act, or the National Forest Management Act. In order to meet these requirements, the No-Action Alternative would need to be substantially modified. Consequently, the historic harvest level and associated employment and revenues are unrealistic and could not be implemented.

## Comparison of the Effects of the Alternatives

Chapter 3&4 describes in detail the environmental consequences of the alternatives. Under each of the alternatives considered, timber harvests of older forests will decline from historic levels. The environmental consequences associated with timber harvest, such as loss of late-successional forest habitat, new road construction, increased stream sedimentation, and water quality degradation, will be proportionately less. Social and economic impacts to timber-dependent communities will be proportionately greater. The preservation of late-successional and old-growth forests will have beneficial consequences to the wildlife and plants associated with them, to water quality and to ecological diversity. The following discussion summarizes and compares the key impacts identified.

## Effects on Late-Successional and Old-Growth Forest Ecosystems

The evaluation of late-successional and old-growth forest ecosystems is expressed as an expected likelihood of achieving long-term past conditions based on three attributes that characterize the quantity and quality of the ecosystem. The attributes are a) abundance and ecological diversity - the acreage and variety of plant communities and environments, b) processes and functions - the ecological actions that lead to the development and maintenance of the ecosystem and the values of the ecosystem for species and populations, and c) connectivity - the extent to which the landscape pattern of the ecosystem provides for biological flows that sustain animal and plant populations. In general, forest plantations, fire suppression, high rates of logging, ownership patterns, and human population and environmental influences have altered the regional ecosystem on Federal lands to the extent that none of the alternatives can provide for a return to conditions that closely match those of previous centuries. Site conditions across all landscapes will not return to their presettlement conditions within the next 100 years. However, all of the alternatives reverse the management trend of the last 50 years on Federal lands, which, if continued, would have resulted in a steep decline in the quantity and quality of late-successional ecosystems and the eventual loss of these ecosystems in many Federal planning areas.

Some of the alternatives provide greater likelihoods than others of maintaining and enhancing late-successional ecosystems at levels that approach typical long-term conditions. Alternatives 1, 3, 4, and 9 received the highest ratings. Alternatives 3 and 4 provide for relatively high amounts of late-successional forest and strong connectivity through the presence of riparian reserves and retention of old-growth components in managed forest matrix. Alternatives 3 and 4 also provide relatively high acreage of low elevation late-successional ecosystems, which are relatively rare throughout the entire region. Although Alternative 1 provides for the highest acreage of Late-Successional Reserves, it did not rate as high as Alternatives 3 and 4 because it lacks restoration silviculture in the reserves.

The Assessment Team assumed that without restoration silviculture, the development of late-successional conditions would be retarded. Alternative 9 achieved a 60 to 80 percent or greater cumulative likelihood of reaching less than long-term average conditions or better in moist provinces. Alternative 9 might have achieved a higher overall rating if it provided for more acreage of late-successional ecosystems in the low elevations of Oregon. The Assessment Team concluded that the opportunities to increase knowledge about ecosystem function and management in the Adaptive Management Areas of Alternative 9 actually increased the likelihood that this alternative would provide late-successional characteristics in the future.

### EFFECTS ON AQUATIC ECOSYSTEMS

The Aquatic Conservation Strategy (Appendix B) was designed to incorporate all elements of the aquatic and riparian ecosystem, including maintenance of hydrologic function, high water quality, adequate amounts of large woody material, a stable, complex stream channel, and a riparian area with suitable microclimate and vegetation. The likelihood of achieving an outcome with sufficient quality, distribution and abundance of habitat to allow plant and animal species to stabilize, well-distributed across Federal lands, is lower for Alternatives 2, 3, 5, 6, 9, and 10 than for Alternatives 1 and 4. However, the Assessment Team determined that all alternatives except 7 and 8 would reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on Federal lands within the range of the northern spotted owl. Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no alternative will completely recover all degraded aquatic systems within the next 100 years. Faster recovery rates are probable for aquatic ecosystems under Alternatives 1 and 4 than other alternatives. Alternatives 1 and 4 would reduce disturbance across the landscape due to application of a larger Late-Successional Reserve network and the use of wider Riparian Reserves for intermittent streams throughout the planning area.

### EFFECTS ON THREATENED AND ENDANGERED SPECIES

All of the alternatives provide for the continued existence of threatened and endangered species. There are 42 federally listed and proposed species which may occur in the planning area. This includes those species whose habitat associations are known to include late-successional forest or are directly associated with such habitat. A portion of the listed and proposed species were eliminated from detailed discussion in this SEIS for one of four reasons: 1) they are not known to occur on the Federal lands of the planning area, 2) they do not inhabit coniferous forests, 3) their use of coniferous forests is not dependent on old-growth conditions, or 4) their presence in the northern spotted owl's range is transitory or unaffected by forest management activities. The alternatives considered in this SEIS will have no effect on these species.

The Fish and Wildlife Service identified those "species that are not restricted to only late-successional forests or that are associated with unique or specialized habitats that may not be considered late successional, but which may be affected by forest management activities." Some of these species were not evaluated by the Assessment Team because of their lack of association with late-successional forests, however, they are addressed in this SEIS to provide a complete accounting. The alternatives in this SEIS are not likely to adversely affect these species.

Three listed or proposed species are associated with late-successional forests: the bald eagle, the northern spotted owl, and the marbeled murrelet. None of the alternatives is likely to adversely affect the bald eagle. The following discussion summarizes the effects of the alternatives on the other two species.

#### Northern Spotted Owl

The effectiveness of an alternative in providing for northern spotted owl recovery on Federal lands relies heavily on the spacing, size and location of the habitat. It was the conclusion of the Assessment Team that Alternatives 1 through 6 and 9 met or exceeded the conservation measures for Federal lands for the *Final Draft of the*

*Northern Spotted Owl Recovery Plan* (USDA 1992a). Alternatives 7, 8 and 10 were found to have less assurance of owl recovery on Federal lands. However, based on the protection of sites in reserves, and matrix management provisions, all of the alternatives are likely to be compatible with recovery of the northern spotted owl. The range of protection for known northern spotted owl sites in the short term (next fifty years) is from 55 percent of owl sites protected under Alternative 7, to 89 percent of sites in Alternative 1. These estimates are for owl sites protected in Late-Successional Reserves, Managed Late-Successional Areas and Adaptive Management Areas only. It is unknown at this time how many additional northern spotted owl sites would be protected from timber harvest as a result of their location in Riparian Reserves within the matrix.

Marbled MurreletIn the short term, the alternatives will provide a varying degree of "reserve" protection for the population of murrelets known to occur in the planning area. However, eight alternatives (all but Alternatives 7 and 8) provide for protection of murrelet sites outside of the reserves. The full impact of this protection outside reserves is not known at this time because of the limited surveys conducted for this species. Over the long term, most of the alternatives would eventually produce substantially more suitable habitat for marbled murrelets than currently exists, and that habitat would be in larger blocks (which is preferable for this species). These results are based, in large part, on the fact that Alternatives 1 through 6 and 10 meet or exceed the recommendations of the murrelet working team. Because Alternatives 7 and 8 did not include the recommendations, they are considered far less protective of murrelets and less compatible with expected marbeled murrelet recovery efforts. Alternative 9 includes a modification of the working team's recommendations, so is better than Alternatives 7 and 8, but not as good as Alternatives 1 through 6 and 10.

### EFFECTS ON SPECIES NOT THREATENED OR ENDANGERED

The Assessment Team determined that 1,084 terrestrial species were closely associated with late-successional and old-growth forests. These species were grouped into bryophytes, fungi, lichens, vascular plants, mollusks, amphibians and reptiles, birds, and mammals. A list of 15 functional groups of arthropods was also considered. Twenty-nine species of fish were determined to occur in streams within late-successional and old-growth forests. Each of the alternatives were evaluated to determine the likelihood of habitat on Federal lands to support populations of these species or groups of species. Expert panels were asked to predict a percent likelihood whether habitat would be of sufficient quality, distribution and abundance for species populations to a) stabilize, well distributed, b) stabilize with significant gaps in distribution, c) continue existence only on refugia, or d) be at risk of extirpation. The assessment process and the potential outcomes that were predicted are described for each of the species or groups of species in Chapter 3&4 and are summarized below.

#### Bryophytes

In general, those alternatives that retain habitat features important to bryophytes associated with late-successional and old-growth forests resulted in higher outcomes. Alternatives 1, 3, 4, 5, and 9 consistently rated higher than Alternatives 7 and 8 for most bryophytes. The riparian prescriptions in all alternatives except 7 and 8 influenced the ratings to be near an 80 percent or greater cumulative likelihood of providing habitat sufficient to allow the species population to stabilize, well distributed for the majority of the bryophyte groups. However, riparian buffer widths were often inadequate to protect the bryophytes that occur in the floodplains. Four extremely rare species have a likelihood of achieving habitat sufficient to allow the species population to stabilize, but with significant gaps in the historic species distribution. The ratings for these four species do not vary by alternative and are not primarily reflective of alternative design. Under all alternatives these four species would need site specific surveys, analyses and site protection.

### Fungi

Projected future likelihoods of maintaining habitat for fungi corresponded with the acreage of Late-Successional Reserves and management in the matrix. Ratings for the groups of fungi varied considerably across the different alternatives. Fungi were rated lower for alternatives that had less acreage of Late-Successional Reserves, fewer old-growth patches, and less large woody debris and green tree retention in the matrix. Most of the common fungi had potential outcomes for well-distributed habitat, or well distributed but with significant gaps. For Alternative 1, 92 percent of the common fungi groups rated 80 percent likelihood of having habitat sufficient to allow the species population to stabilize, well distributed, and 72 percent of the groups received this rating for Alternative 3. Alternatives 4, 5, and 9 had lower ratings with 16 to 20 percent of the fungi groups rating an 80 percent likelihood of a stabilized, well-distributed population; 8 percent received this rating for Alternatives 7 and 8.

Rare or uncommon fungi totaled 146 species, or 28 percent of the fungi evaluated and represent the species of greatest concern. The rare and locally endemic species were generally rated with an 80 percent likelihood of populations being restricted to refugia which reflects their current distribution. There was, however, a spread of uncertainty for populations achieving some level of well distributed with gaps or a risk of extirpation. For many of these species, there was little difference in ratings across the alternatives. This reflects the relatively random chance that a population will actually occur within a given reserve.

### Lichens

Outcome ratings were generally highest for Alternatives 1, 3, and 4; intermediate under Alternatives 5 and 9; and lowest under Alternatives 7 and 8. Outcome ratings for lichens were generally correlated with the acreage of Late-Successional Reserves, stand treatments within the matrix, and protection for riparian corridors (aquatic and riparian lichens). Rare lichens rated much lower than common lichens because some of the rare lichen species have narrow geographic ranges and only occur in specialized habitats. Under Alternative 9, there are three species groups for which the 80 percent cumulative likelihood included risk of extirpation. However, these three groups could not rate higher than being restricted to refugia under any of the alternatives due to their narrow geographic range and occupancy of specialized habitats. Seven species groups have 80 percent cumulative likelihoods of being restricted to refugia or better under Alternative 9. Three of these groups are rare; two are associated with aquatic and riparian areas (which receive less protection under Alternative 9 than under Alternatives 1 and 4); and two are closely associated with late-successional and old-growth forests (which receive greater protection under Alternative 1 than 9).

**Vascular Plants**

A total of 110 vascular plants (84 percent) received a greater than 80 percent likelihood of achieving well-distributed habitat sufficient to allow populations to stabilize in Alternative 1. The overall ratings of Alternatives 3, 4, and 5 were similar to each other, but lower than Alternative 1. Alternative 9 tended to have lower probabilities of achieving well-distributed habitat than Alternatives 3, 4, and 5, but were higher for most species than Alternatives 7 and 8. Alternatives 7 and 8 consistently received the lowest ratings. Ratings tended to be lowest for rare species that were geographically restricted or sparsely distributed throughout a larger range. Two species were considered to have a risk of extirpation within portions of their range under Alternative 1, while three species were considered to have a greater than 40 percent cumulative likelihood of extirpation under Alternative 7. In Alternative 1, 22 species had less than 80 percent likelihood of achieving well-distributed habitat. Five of these species are endemics, three are on the periphery of their range, and thirteen are rare or uncommon. In Alternative 7, 53 species had less than an 80 percent likelihood of achieving well-distributed habitat. Under Alternative 9, 39 species had less than an 80 percent likelihood of achieving well-distributed habitat.

In addition to the 22 species that received a similar outcome in Alternative 1, two commercially important conifers were included in this category for Alternative 7. Pacific yew and Port-Orford-cedar would have less than an 80 percent likelihood of being well-distributed throughout their range under Alternative 7. Pacific yew in the Klamath/Siskiyou Physiographic Province and Port-Orford-cedar throughout its range are included in this category. Both species received higher ratings in Alternative 1 than in any other alternative due to the protection of the smaller late-successional and old-growth fragments that are important to these species.

**Arthropods**

For most functional groups, Alternatives 1 and 3 provide the greatest likelihood that arthropod function will be maintained across Federal lands. Twelve and nine of the 15 groups or ranges, respectively, were given an 80 percent likelihood for well-distributed populations under these alternatives. Alternatives 4, 5, and 9 provide for a lower likelihood with six, five, and five groups, respectively, reaching an 80 percent likelihood of being well-distributed. Alternatives 7 and 8 provide for only minimal likelihood that arthropod function would be maintained, with three and two groups, respectively, receiving an 80 percent likelihood for well-distributed populations.

**Mollusks**

Only Alternative 1 provides habitat to maintain any of the mollusk species well-distributed across Federal lands with a likelihood of 80 percent or better. Assessments for Alternatives 3, 4, 5, 7, 8 and 9 indicate that a large number of species will have substantial probabilities of being restricted to refugia or a risk of extirpation. Differences among the alternatives were based primarily on the total acres proposed for reserves, the locations of specific reserves, and the management proposed within reserves; and on the proposed forms of watershed protection (for freshwater snails and clams). Alternatives 1 and 4 contain full riparian protection measures and analysis shows that the freshwater species would fare better under these alternatives. High degrees of endemism and rareness account, in part, for the low ratings assigned the mollusks. Many of the mollusk species are endemic to only one area or river drainage, and their dispersal capability is low. Under Alternative 9, there were 20 mollusk species for which the 80 percent cumulative likelihood included risk of extirpation.

Amphibians and Reptiles Ratings for individual species were highly variable among alternatives. Because of the preponderance of riparian-associated species, overall results of the analysis reflected the level of riparian buffer protection along headwater and intermittent streams in each alternative. Alternatives 1 and 4, which included the widest buffer widths on all intermittent streams and seeps, had the greatest number of species with high likelihoods of having well-distributed, stable populations over the next 100 years. Overall ratings for Alternatives 3, 5, and 9 were very similar, again reflecting their similar riparian standards. Alternatives 7 and 8 had much lower overall ratings. No species had a high likelihood for a stable, well-distributed population under Alternative 7 and only one species had such a likelihood under Alternative 8. Eleven of the 19 species or subpopulations occur as endemics, restricted through habitat specialization and geographic subtleties to small, isolated populations. These small populations are at risk to local extirpation through either land management activity or catastrophic habitat modification due to natural events. Three species had an 80 percent likelihood of being restricted to refugia or extirpation for all of the alternatives. Ratings for these species should not be considered a function of the management of Federal lands. Under Alternative 1, there is an 80 percent or greater likelihood that distribution for 16 species would be well-distributed or have gaps. Of these, 14 were well distributed. In contrast, Alternatives 3, 4, 5 and 9 provide habitat conditions for 16 species resulting in an 80 percent likelihood of being well distributed or having gaps, but only half of these species were most likely to be well distributed. For Alternatives 7 and 8, five species were rated as achieving an 80 percent cumulative likelihood of being restricted to refugia or better and three for which the 80 percent cumulative likelihood included risk of extirpation.

### Birds

Ratings for individual species were similar among alternatives. Alternatives 1, 3, 4, and 5 provided habitat to maintain all 36 bird species well distributed with a likelihood of 80 percent or better. For Alternatives 7 and 9, the Assessment Team concluded that 35 species had an 80 percent or greater likelihood of having a well-distributed population. In Alternative 8, seven species were rated as having less than an 80 percent likelihood of having a well-distributed population, and one species was rated as having less than a 60 percent likelihood of being well distributed. For 19 of the 36 bird species, all 7 alternatives were rated as providing a 100 percent likelihood of maintaining a well-distributed population. Of those that did not rate 100 percent likelihood, most need further study to address habitat needs. In addition, the ranges of a number of species only slightly overlap the range of the northern spotted owl. Alternative 7, which included narrow riparian buffers, rated lower for a number of waterfowl that nest adjacent to streams or lakes. Alternative 8, which allowed considerable salvage and harvest within reserves, rated lower than most other alternatives for a number of woodpeckers and other cavity nesters that depend upon large snags. Alternatives 7 and 8 also rated lower for a number of species because neither alternative included the mitigation measures identified in other alternatives for selected species thought to be at risk under the existing agency plans.

### Mammals

For mammals other than bats, the alternatives were generally rated as having above an 80 percent likelihood of providing habitat sufficient to allow a stabilized, well-distributed population except for red tree voles, martens, and fishers. In general, those alternatives that provided for greater amounts of late-successional and old-growth habitat resulted in higher likelihoods of producing this outcome. Alternatives 1, 3, 4, and 5 were rated as providing greater than an 80 percent likelihood of achieving a well-distributed population for both species of red tree voles. Ratings were progressively lower for Alternatives 9, 8 and 7, respectively, where the likelihood ranged from 78 down to 58 percent. American martens were rated for the entirety of their range within the range of the northern spotted owl. They were rated as having a greater than 80 percent likelihood of achieving a stabilized, well-distributed population under Alternative 1. Alternatives 3 and 4 were rated 73 to 77 percent for this outcome. Ratings for Alternatives 5, 8, and 9 were lower with approximately 67 percent likelihood of achieving this outcome. Alternative 7 rated lowest, with less than a 60 percent likelihood of achieving a stabilized, well-distributed population. Ratings for the fisher were similar to those for martens. Ratings for percent likelihood of achieving a well-distributed population for Alternatives 1, 3, 4, 5, 7, 8 and 9 were, respectively, 85, 82, 73, 70, 67, 63, and 63. Ratings for fisher reflected a general uncertainty about the future welfare of this species regardless of the alternative. All alternatives rated above a cumulative 80 percent likelihood, for all species examined, of providing habitat sufficient to allow the species population to stabilize, but with significant gaps in distribution.

For bats, the different alternatives varied in their likelihoods of providing sufficient and well-distributed habitat to ensure persistence. Alternatives 1 and 3 were rated highest, and Alternatives 7 and 8 rated lowest. All species rated more than 80 percent likelihood for well-distributed populations under Alternatives 1 and 3. For Alternative 4, eight species rated more than an 80 percent likelihood for this outcome. Under Alternative 5, four species rated more than an 80 percent likelihood for well-distributed populations, and seven species rated 65 to 73 percent. For Alternative 9, four species rated more than 80 percent for this outcome, two species rated 60 to 70 percent, and five species rated 45 to 55 percent. No species rated more than 80 percent for achieving a well-distributed population under Alternatives 7 or 8, and seven species rated less than 60 percent under each of these alternatives.

## Aquatic Species

Alternatives 1 and 4 had the highest likelihood of attaining habitat to allow fish species to stabilize well distributed; the likelihood was 80 percent or higher for all races/species/groups. The relatively high likelihood for these alternatives was because of the large amount of area in reserves and the riparian strategy on all federal lands within the range of the spotted owl proposed for these alternatives. Alternatives 2, 3, 5, 6, 9, and 10 generally had a 60 to 70 percent likelihood of attaining habitat to allow widely-distributed races/species/groups. Alternatives 7 and 8 had the lowest likelihoods of attaining habitat to allow stabilized, well-distributed races/species/groups. The likelihood of attaining this habitat for Alternative 7 was from 10 to 15 percent, the exception being bull trout, which was 35 percent. Alternative 7 was ranked low primarily because of the low amount of riparian areas and the amount of activity that was allowed within them in agency land management plans.

Likelihoods of attaining well-distributed races/species/groups were slightly higher for Alternative 8 than for Alternative 7 but were less than for the other alternatives. Likelihoods of attaining this habitat ranged from 20-25 percent for all groups except bull trout, which was 45 percent, in Alternative 8. Alternative 8 has a lower likelihood of attaining habitat to allow well-distributed races/species/groups than did alternatives other than 7 because of the reduced size of Riparian Reserves, particularly for intermittent streams.

### EFFECTS ON TIMBER HARVEST LEVELS

Estimates according to the BLM and Forest Service indicate that timber sales planned in Federal forests in the range of the northern spotted owl under the No-Action Alternative would have been 3 to 4 billion board feet per year in the 1990's, generating more that $1 billion annually in economic benefits in the Pacific Northwest. Annual harvest levels from Federal forests had averaged 5.6 billion board feet during the period 1980 to 1989. The alternatives considered to protect the habitat of the northern spotted owl and associated late-successional species will restrict timber harvest in these forests, resulting in substantial social and economic costs.

The probable levels of Federal timber sales for the first decade for each alternative are summarized in Figure VI-2, First Decade Probable Timber Sale Levels (PSQ) for Alternatives and Historic Harvest Levels. Figure VI-2 includes "other wood" which is the volume of cull, salvage, and other products that is not normally part of allowable sale quantity calculations. Historically, this has accounted for about 10 percent of the total harvest volume from Federal lands in the planning area. Sale levels in subsequent decades do not increase to any notable extent.

Estimated sale levels under all alternatives are below program levels of the 1980's, as well as below the harvest levels of 1990-1992. Almost all new Federal timber sales in the planning area have been enjoined. In 1990-1992, harvest consisted of sales under contract from the 1980's. The allocations and the standards and guidelines of the alternatives will not permit 1990-1992 levels of timber harvest in the future. In the next 1 to 3 years, the outlook for sale levels is substantially less than the average sales potential for the decade.

In addition to reduced harvest quantities in the decade ahead, wood quality is also apt to decrease. In the first decade, thinnings and other partial harvests would account for a large proportion of the volume harvested under the various alternatives. Secondary wood products manufacturers may see an even greater decline in the amount and quality of wood stock than the probable sale quantities would indicate as a result of smaller average log size.

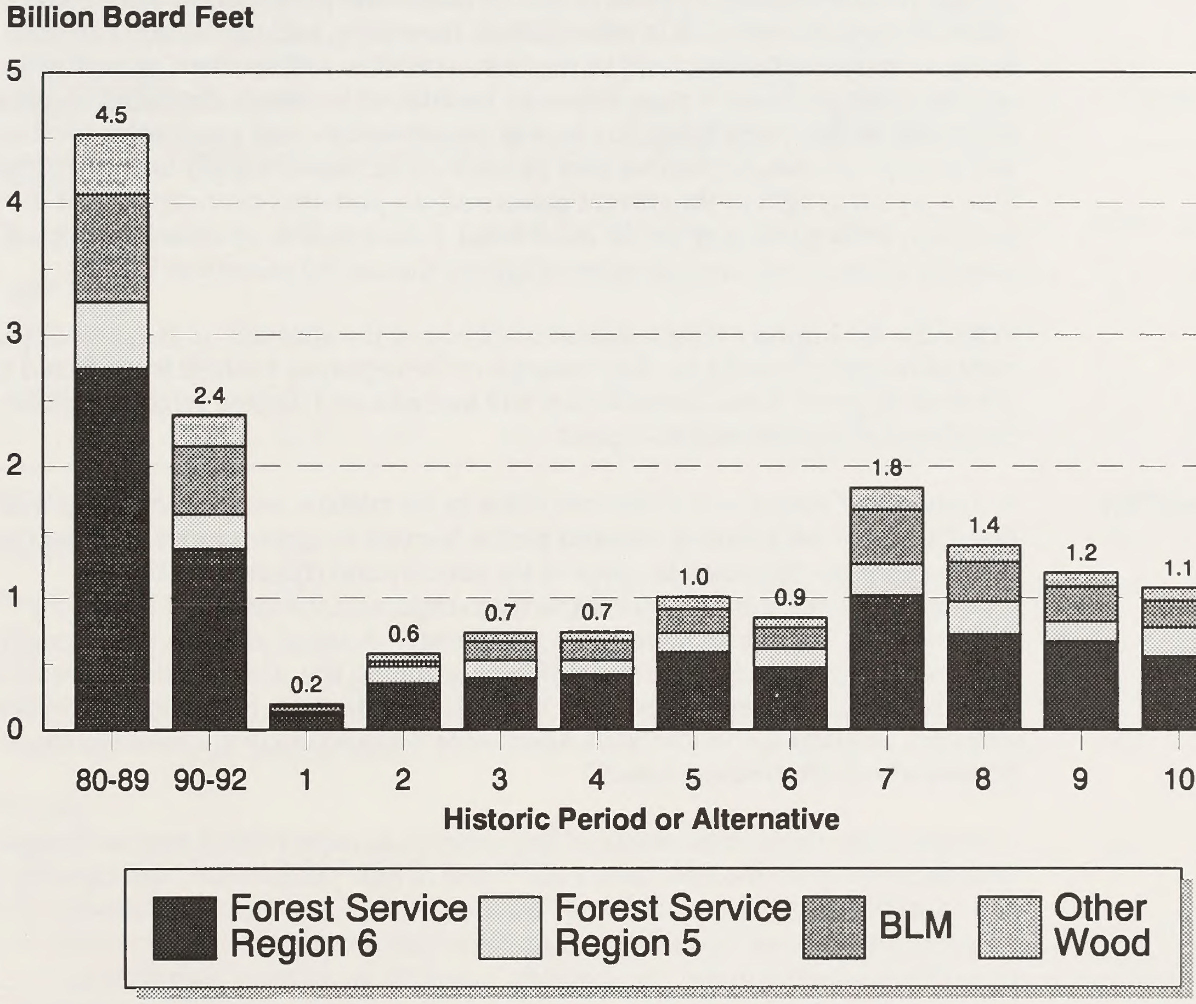
### EFFECTS ON REGIONAL ECONOMICS AND COMMUNITIES

#### Regional Employment

Under all of the alternatives, direct employment in timber harvesting and processing will decline as a result of reduced harvest levels as shown in Table VI-16, Historic and Projected Employment in Timber Industries in the Next Decade by Sub-Region and Alternative. Projections imply a range of job displacement from 1,700 to 12,500 jobs relative to 1992. However, compared to 1990 employment levels, these projections predict displacement of 21,200 to 32,000 jobs. The majority of the jobs affected are located in Oregon, and are concentrated in southwestern Oregon.

The alternatives presented in this Draft SEIS would have the greatest effect on the timber industry sector. In addition to the workers displaced, there would be

**Figure VI-2.** First decade probable timber sale levels (PSQ) for alternatives and historic harvest levels.



"indirect effects" caused by fluctuating business expenditures in the region and "induced effects" caused by changes in personal expenditures in the region. These ripple effects tend to increase the ramifications of job gains or losses in communities or regions. There is roughly one job lost outside the timber industry for every job affected within the timber industry. The subregions that are characterized as heavily timber- dependent are apt to see the most severe impacts. While service employment in forestry appears to also be faced with job declines, these could be offset through investments in reforestation, inventory, and restoration activities. Some employment gains could be made in recreation and tourism, as well as in special forest products. It may, however, be difficult to absorb displaced loggers and mill workers into these fields due to skill considerations and geographic locations. In the long run, the alternatives may provide an increased supply to commercial fisheries, but in light of the current issues and the potential over-capacity of the industry, these gains may not be substantial. Rehabilitation of salmon and trout runs, however, could have positive effects on the coastal recreation fishery.

While the net impact of implementation of any of the alternatives is apt to displace natural resource-based jobs, the economy of the region as a whole is predicted to continue to grow. Rural communities will lose jobs and decline while the more developed areas continue to expand.

### Rural Communities

Washington, Oregon, and California differ in the pattern, severity, and regional distribution of the effects of reduced timber harvest to communities. The results of the analyses are discussed in terms of the severity and direction of the consequences, the communities' capacity to cope, and the resultant risk to the communities. The Assessment Team conducted a detailed analysis of Alternatives 1, 3, and 7. It found relatively few differences among the effects of the alternatives because the timber harvest levels in Alternatives 1 through 10 are far below recent averages. Impacts associated with Alternative 9 would likely fall between those presented for Alternatives 3 and 7.

Communities with combinations of low capacity to cope with change and negative consequences from the alternatives are "most at risk"; those with high capacity to cope and positive consequences are "least at risk." Using these definitions, Alternatives 1, 3, and 7 would result in about one-third of the 167 surveyed communities falling in the "most at risk" category. In all three alternatives, however, the changes are great compared to those for the 1985-87 harvest level scenario in which only 3 percent of the communities were so ranked. The majority of the communities "most at risk" in Alternatives 1, 3, and 7 are those highly dependent on the timber industry and on Federal forest lands as the source for much of their timber supply. Alternatives 1, 3, and 7 would likely lead to additional mill closures and reduced forest related employment, and to real damage to the economic and social infrastructure.

The "most at risk" communities differ from others in significant ways. These communities are smaller (average population 3,000), and they are located in counties with low population density. Isolated communities are more likely to experience negative consequences with Alternatives 1, 3, and to a lesser degree 7, because they have few options available locally or in nearby communities, and because of limited access to capital, transportation links, and other resources. Communities that are small, isolated, and lacking economic diversity are more likely to be "at risk" than others. These communities may find it difficult to mobilize and respond to changing conditions which may affect a variety of groups. These communities are likely to experience unemployment, increased poverty, and social disruption in the absence of assistance.

**Table VI-16.** Historic and projected employment in timber industries in next decade, by subregion in the study area and alternative.[1]

| | Actual | Estimated | Alternative | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State/Region | 1990 | 1992 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | ----------thousand jobs-------------- | | | | | | | | | |
| Washington - | | | | | | | | | | | | |
| Olympic Peninsula | 13.9 | | 12.0 | 12.1 | 12.1 | 12.0 | 12.1 | 12.0 | 12.0 | 12.0 | 12.1 | 12.0 |
| Puget Sound | 25.7 | | 20.9 | 21.0 | 21.0 | 21.0 | 20.9 | 21.0 | 20.9 | 21.1 | 21.0 | 21.0 |
| Lower Columbia | 14.1 | | 12.7 | 12.8 | 12.8 | 12.8 | 12. | 12.8 | 12.9 | 12.9 | 12.9 | 12.8 |
| Central | 4.2 | | 4.0 | 4.2 | 4.3 | 4.2 | 4.3 | 4.3 | 4.4 | 4.5 | 4.3 | 4.4 |
| *Total* | *57.9* | *51.3* | *49.7* | *50.1* | *50.1* | *50.0* | *50.2* | *50.1* | *50.3* | *50.5* | *50.2* | *50.2* |
| Oregon - | | | | | | | | | | | | |
| Northwest | 21.9 | | 20.4 | 20.8 | 20.9 | 21.0 | 21.3 | 21.0 | 22.3 | 21.4 | 21.3 | 21.1 |
| West-Central | 20.9 | | 14.3 | 14.8 | 14.9 | 15.0 | 15.4 | 15.1 | 16.4 | 16.0 | 15.9 | 15.5 |
| Southwest | 21.4 | | 11.0 | 12.3 | 12.5 | 12.6 | 13.1 | 12.8 | 15.7 | 14.2 | 13.9 | 13.2 |
| Central | 8.9 | | 7.5 | 8.0 | 8.0 | 7.9 | 8.1 | 8.0 | 8.4 | 8.0 | 8.2 | 8.0 |
| *Total* | *73.1* | *62.8* | *53.2* | *56.0* | *56.3* | *56.6* | *57.9* | *56.9* | *62.8* | *59.5* | *59.3* | *57.7* |
| California - | | | | | | | | | | | | |
| *Total* | *13.9* | *11.3* | *10.0* | *10.5* | *10.5* | *10.4* | *10.5* | *10.5* | *10.6* | *10.9* | *10.3* | *10.8* |
| All States - | | | | | | | | | | | | |
| ***TOTAL*** | ***144.9*** | ***125.4*** | ***112.9*** | ***116.6*** | ***116.9*** | ***117.0*** | ***118.6*** | ***117.5*** | ***123.7*** | ***120.9*** | ***119.8*** | ***118.7*** |

[1] Includes self-employed in all solid wood products and pulp and paper sectors. Wage and salary employment is approximately 7.5 percent less than total employment. The study area includes the counties that fall, whole or in part, within the range of the northern spotted owl.

# Chapter 3&4
## Affected Environment and Environmental Consequences

Introduction ........ 3&4-1
Incomplete or Unavailable Information ........ 3&4-2
Cumulative Impacts ........ 3&4-2
Regional Introduction ........ 3&4-3
  Overall Land Ownership Patterns ........ 3&4-3
  Brief History of Resource Management in the Pacific Northwest ........ 3&4-4
  Description of Terrestrial Forest and Aquatic Ecosystems ........ 3&4-6
    Overview of Biological Communities, Ownership Patterns and Current Forest Conditions by Physiographic Province ........ 3&4-6
  Descriptions of Physiographic Provinces ........ 3&4-8
Terrestrial and Aquatic Ecosystems ........ 3&4-14
  Affected Environment ........ 3&4-14
    Current Forest Conditions Within the Range of the Northern Spotted Owl ........ 3&4-14
    Current Aquatic Conditions ........ 3&4-22
  Environmental Consequences ........ 3&4-28
    Methods for Assessing the Effects of Alternatives ........ 3&4-28
    Effects of Alternatives on Terrestrial Ecosystems ........ 3&4-39
  Threatened, Endangered and Proposed Species ........ 3&4-50
    Listed and Proposed Species Indirectly Associated with Late-Successional Forests ........ 3&4-51
    Listed and Proposed Species Associated with Late-Successional Forests ........ 3&4-57
  Species not Threatened or Endangered ........ 3&4-63
    Nonvascular Plants and Allies ........ 3&4-63
    Vascular Plants ........ 3&4-72
    Invertebrates ........ 3&4-78
    Amphibians and Reptiles ........ 3&4-84
    Birds ........ 3&4-87
    Mammals Other Than Bats ........ 3&4-90
    Bats ........ 3&4-92
    Aquatic Species ........ 3&4-95
    Species Associated with Early Succesional Forests ........ 3&4-101
  The Three Court-Identified Defects in the FEIS ........ 3&4-102
    Introduction ........ 3&4-102
    Response to Defects ........ 3&4-102
The Economy and Communities ........ 3&4-105
  Overview ........ 3&4-105
    Timber Harvest ........ 3&4-106
    Mineral Resources ........ 3&4-113
    Range/Grazing Resources ........ 3&4-115
    Special Forest Products ........ 3&4-115
    Commercial Fisheries Resources ........ 3&4-116
    Recreation Resources ........ 3&4-116
    Water Quality ........ 3&4-118
    Scenic Quality, Air Quality, and Other Public Goods ........ 3&4-118
  Regional Employment ........ 3&4-119
    Affected Environment ........ 3&4-119
    Methodology ........ 3&4-123
    Environmental Consequences ........ 3&4-125
  Government Revenues ........ 3&4-128
    Affected Environment ........ 3&4-128
    Environmental Consequences ........ 3&4-128
  Rural Communities ........ 3&4-130
    Effects of Reduced Timber Sales ........ 3&4-130
    Native American Peoples and Culture ........ 3&4-137
Other Environmental Consequences ........ 3&4-138
Adverse and Long-Term Consequences ........ 3&4-138

# Chapter 3&4 Affected Environment and Environmental Consequences

**KEY TERMS**

**Associated Species -** A species that is more abundant in a particular forest successional stage than in other areas.

**Biological Diversity -** The variety of life forms and processes.

**Candidate Species -** Those plants and animals identified by the Fish and Wildlife Service for listing as threatened or endangered.

**Cumulative Effects -** Effects on the environment that result from the incremental effect of the action when added to the past, present, and reasonably foreseeable future actions.

**Effects -** Synonymous in this SEIS with impacts and consequences. Effects may be direct, indirect or cumulative.

**Forest land -** Land that is now, or is capable of becoming, at least 10 percent stocked with forest trees.

**Key Watershed -** A watershed containing (1) habitat for potentially threatened species or stocks of anadromous salmonids or other potentially threatened fish, or (2) greater than 6 square miles with high-quality water and fish habitat.

**Mitigation measures -** Modifications of actions thatavoid, minimize, rectify, reduce, or compensate for impacts of the actions.

**Standards and Guidelines -** Management direction to achieve ta land management decision.

## Introduction

Chapter 3 (Affected Environment) and Chapter 4 (Environmental Consequences) have been combined in this document to more clearly present information to readers. The description of a resource or environmental component appears just before the description of environmental consequences to that resource or component. Most environmental impact statements place them in separate chapters.

This chapter presents information about those aspects of the environment that are affected by the management prescribed in the alternatives. It also presents the direct and indirect effects (or impacts) of management under the alternatives. Because of the broad programmatic nature of the impacts evaluated for each coordinated

Federal management alternative, this also constitutes a presentation of the cumulative impacts of each alternative. Together these form the scientific and analytic basis for the Comparison of the Effects of the Alternatives section in Chapter 2.

## Relationship to the FEMAT Report

Chapter 3&4, as well as the alternatives, are adapted from the Forest Ecosystem Management Assessment Team's report Forest Ecosystem Management: An Ecological, Economic, and Social Assessment ("the FEMAT Report"). That complete report is Appendix A of this Draft SEIS. It is incorporated by reference as part of this SEIS and is an uncirculated appendix. Information on how to obtain a copy of the FEMAT Report is presented in the Appendix A section at the back of this Draft SEIS. **Tables, figures, and quotations in this chapter which carry Roman numerals duplicate those in the FEMAT Report. Citations to literature not included in the References section of the Draft SEIS are in the References at the end of chapters in the FEMAT Report.**

## Incomplete or Unavailable Information

There is less than complete knowledge about many of the relationships and conditions of wildlife species, forests, the economy, and communities. The ecology, inventory, and management of large forests is a complex and developing science. The biology of the specific species prompts questions about population dynamics and habitat relationships. The interaction of resource supply, the economy, and communities is also the subject of an inexact science.

The Assessment Team and the Interdisciplinary Team for this SEIS examined the data and relationships used to estimate the effects of the alternatives. There is a substantial amount of credible information about the topics of this environmental impact statement; the basic data and the central relationships are well established. The best available information was used to evaluate the options and alternatives. When encountering a gap in information, the question implicit in the Council on Environmental Quality (CEQ) regulations on incomplete or unavailable information was posed: Is this information "essential to a reasoned choice among alternatives"? (40 CFR 1502.22(a)). While the missing information would frequently add precision to estimates or better specify a relationship, the basic data and central relationships are sufficiently well established in the respective sciences that the new information is very unlikely to reverse or nullify understood relationships. Though new information would be welcome, it is not essential to a reasoned choice among the alternatives as they are constituted.

It is relevant to note also that each of the alternatives incorporates an adjustment process that provides for modification of habitat management should new scientific information warrant a change in management. This adjustment process, which is guided by monitoring and research, provides additional assurance of compensating for possible catastrophic effects.

## Cumulative Impacts

"Cumulative impacts" or cumulative effects are those impacts on the environment which result from the incremental effects of a proposal when added to other past, present, and reasonably foreseeable future actions regardless of which agency or person undertakes them. Cumulative effects of individually minor actions over a period of time can be significant.

The 10 action alternatives examined in this Draft SEIS establish management direction for a large number of projects on lands administered by the Forest Service and BLM, most of which, by themselves, have no significant environmental impacts. The environmental consequences described in this chapter thus constitute an evaluation and description of their cumulative impacts.

The alternatives provide coordinated land and resource management direction across the Federal forests within the range of the northern spotted owl. This assures that the cumulative effects on over 24 million acres of this region's ecosystems were considered in the design of the alternatives (or options), and the negative cumulative impacts would be minimized or avoided through coordination among the agencies as the selected alternative is implemented.

The evaluation of cumulative effects needs to consider the incremental impact of actions on lands owned and managed by states, tribes, corporations, individuals, and other nonfederal agencies. It is important to note that the lead agencies here (the Forest Service and the BLM) have no authority to regulate activities or their timing on lands other than those they administer.

Road construction and use and timber harvest are the principal activities on nonfederal forest lands which make an incremental contribution to the cumulative impacts disclosed in this Draft SEIS. The amount and timing of that harvest can be anticipated from the age of the timber stands and the anticipated prices for timber. In addition, timber harvest on nonfederal forest lands is controlled by state timber practices acts, and by a number of state and Federal regulations, to protect the productivity and environmental quality of the land. As a result, the amount and character of timber harvest activity in the first decade, and thus the cumulative environmental impact from nonfederal lands, is similar under all 10 alternatives (Figure II-18 and Figure VI-4, Appendix A).

The environmental impact statements which this Draft SEIS supplements also disclosed the cumulative effects of their alternatives on various aspects of the environment. Those effects are substantially reduced in these 10 alternatives because the amount of ground-disturbing activity associated with road construction and timber harvest will be substantially lower than in the alternatives selected and preferred in the EISs being supplemented.

In addition, all ground-disturbing actions are conducted only after site-specific environmental analysis. This site-specific analysis will also analyze the cumulative impacts of the project alternatives on adjacent lands and resources, and on the watershed. This provides an opportunity to detect and minimize cumulative environmental effects that cannot be ascertained at the programmatic level of this SEIS.

## REGIONAL INTRODUCTION

### Overall Land Ownership Patterns

The planning area of this SEIS, defined in Chapter 2, consists of lands administered by the Forest Service and the Bureau of Land Management within the range of the northern spotted owl. This geographic area includes western Washington, western Oregon, and northwestern California south to Marin County (see Federal Land Ownership within the Range of the Northern Spotted Owl map in the accompanying map packet). With the exception of some lowland interior valleys and coastal plains, this area is dominated by mountainous terrain and coniferous forests.

Forest lands within the range of the northern spotted owl are owned or administered by a variety of private, state, and Federal entities, including the Forest Service (19 National Forests, 19.4 million acres), Bureau of Land Management (Eight Districts, 2.7 million acres), National Park Service, Indian tribes, state departments of forestry or natural resources, public municipalities, and thousands of private landowners. Some Federal lands, especially those administered by the Bureau of Land Management in western Oregon, are intermixed with private lands in a checkerboard pattern of alternating, square-mile sections. In contrast, lands administered by the Forest Service tend to be more contiguous, with fewer inclusions of private land.

## Brief History of Resource Management in the Pacific Northwest

The first documented human use in the region began over 10,000 years ago. Native American groups occupying the region were primarily hunter-gatherers who had little impact on the streams or the aquatic communities. The major recognized impact was the use of fire for maintenance of oak savanna woodland and native prairie grassland ecosystems, particularly in the larger river valleys. Local impacts on forest ecosystems were varied, but include the use of fire to maintain vigor in berry fields. Subregional effects of activities on the land by Native Americans remain in question.

Cutting of forests in the Pacific Northwest began in the 1800's when the first non-Indian immigrants began to settle and farm in the interior valleys of western Oregon and the Puget Sound region. Initially the extensive forests, including riparian areas, that covered much of the landscape were viewed as an impediment to progress and were cleared and burned to make way for agriculture. Stream and river channelization and the removal of large wood and riparian vegetation helped to drain the extensive wetlands and to increase the rate of water runoff.

In the late 1800's and early 1900's, extraction of lumber began to increase. Lumber camps were built around the region, especially in areas accessible by river or steam locomotive. Lowland areas close to human population centers were logged first, followed eventually by less accessible areas in more mountainous terrain. Timber harvest occurred mainly in the riparian or adjoining upslope areas where logs could be readily accessed. The only method of moving logs out of the woods was by water. Extensive use was made of the streams and rivers to float out large rafts of logs. In some cases, logs were piled in the stream and floated out on the first flood. Later, more use was made of splash dams that stored water to be released all at once to carry the logs downstream. While the use of splash dams declined as other technologies developed, it persisted into the 1950's.

Logging in these early years frequently consisted of a harvest in which noncommercial species, large trees with minor defect, and many small diameter trees were left following logging, with little or no attention to replanting. Because of the seemingly inexhaustible supply of trees and the considerable labor required to fell them with hand saws and axes, trees with low commercial value were frequently left standing.

Shortly after World War II, the invention of the gas-powered chainsaw and improvements in transportation, logging began in earnest on Federal lands in the Pacific Northwest. European methods of forest management were gradually adopted on most Federal and private lands, including techniques such as clearcutting, removal of logs and snags, slash burning, thinning, and planting of single species stands on harvested areas. Forest fragmentation was encouraged in order to increase habitat conditions preferred by deer and elk populations. Extensive road systems were developed to facilitate harvest and provide easy access for hunting and fishing. Revenues from timber harvest improved local government economies and provided substantial funds to the Federal treasury. The assumption was that forests managed in this manner could be cut and regrown at relatively short intervals (e.g., 40-80 years) without negatively affecting other resources such as water quality, fish, soils, or terrestrial animals.

Transportation networks were typically built in the valley bottoms in the riparian zone. As erosion increased, stream conditions declined. Flooding increased the public's awareness of these declines in stream conditions, particularly the Christmas Flood of 1964. This eventually led to changes in management of riparian areas, with increasing protection being give to the habitat needs of salmon, trout, and steelhead.

A century of logging and wildfires has resulted in a highly fragmented mosaic of recent clearcuts, thinned stands and young plantations interspersed with uncut natural stands. The natural stands that remain range from 1,000-year-old forests of large trees to relatively young, even-aged stands that resulted from recent wildfires. Because wildfires, windstorms, insects and diseases often killed only some of the trees in a forest, natural stands are frequently characterized by uneven-aged mixtures of trees that survived at least one disturbance event. The event opened the tree canopy, after which younger trees filled in the understory. Stands where many large old trees remain in the overstory are usually referred to as "old-growth forests" while stands where only scattered individuals or patches of large old trees remain, and the majority of the stand consists of young or mature trees, is referred to "uneven-aged" or "young." Uneven-aged stands are particularly common in areas where extensive fires occurred in the 1800's. Uneven-aged stands defy categorization - they are not "old growth" in the classical sense (Franklin and Spies 1991, Spies and Franklin 1991), and they are certainly not young even-aged stands. It is these mixed-age stands that have lead to much of the debate over how much "old-growth forest" is left in the Pacific Northwest.

It is important to distinguish between an arbitrary definition of "old growth" and real differences in functions or process. Many mixed-age stands that include only scattered individuals or patches of old trees in a matrix of mature trees probably function much like classical "old-growth" stands that have large numbers of old trees. The term "old growth" may be useful for defining a general concept, but is only marginally useful as an indicator of real differences in processes or functions.

Studies on the ecology of late-successional forests, which include mature and old-growth age classes, began to proliferate in the 1970's and 1980's. It gradually became apparent that a simplistic approach to forest management based on high-yield, short-rotation forestry was probably not going to adequately protect the considerable biological diversity that was present in late-successional forests and their associated aquatic ecosystems. The northern spotted owl was the first species to receive recognition in this regard. It was followed closely by the marbled murrelet, anadromous fish, and a variety of species that are closely associated with old-growth forests (Thomas et al. 1993). More recently, ecologists, foresters, and the public have begun to recognize that the old-growth forests that remain in the Pacific Northwest are unique ecosystems that under present climatic and disturbance regimes will likely never be duplicated. The invasion by nonnative species, the construction of engineered structures (e.g. roads and dams), and increased growth in rural areas have caused long-term alterations in the natural ecosystem. Changes in public perceptions and management expectations of Federal lands in the Pacific Northwest have led to an increase in protection of ecosystems, including riparian areas. They have also led to experimentation with methods of "new forestry" which is designed to retain some of the structural features found in old-growth forests and more closely imitate natural disturbance.

## Description of Terrestrial Forest and Aquatic Ecosystems

### OVERVIEW OF BIOLOGICAL COMMUNITIES, OWNERSHIP PATTERNS AND CURRENT FOREST CONDITIONS BY PHYSIOGRAPHIC PROVINCE

The physiographic provinces (also referred to as "provinces" or "geoclimatic provinces") incorporate physical, biological and environmental factors that shape broad-scale landscapes. Physiographic provinces reflect differences in geology (e.g., uplift rates, recent volcanism, and tectonic disruption) and climate (e.g., precipitation, temperature, and glaciation). These factors result in broad-scale differences in soil development and natural plant communities. Within each province, variable characteristics of rock stability affect steepness of hill slopes, landforms, soil texture, soil thickness, drainage patterns, and erosional processes. Thus, physiographic provinces have utility in the description of both terrestrial and aquatic ecosystems, as well as in the management and land use planning of these ecosystems.

Rates of harvest and natural disturbance have varied tremendously in different provinces within the range of the northern spotted owl, depending on land ownership patterns, topography, climate, soils, and proximity to centers of human population. As a result, some provinces, such as the Oregon Coast Range and the Western Washington Lowlands Provinces, contain relatively little remaining late-successional and old-growth forest, while other provinces such as the Oregon Cascades still retain extensive areas of such forests. These patterns have been described in detail (e.g., Franklin and Dyrness 1973, Thomas et al. 1990, Ruggerio et al. 1991, USDI 1992) and will only be briefly summarized here.

The Northern Spotted Owl Recovery Team divided the range of the northern spotted owl into 12 provinces based on differences in vegetation, soils, geologic history, climate, land ownership, and political boundaries (USDI 1992). These provinces are considerably different in the kinds and amounts of late-successional and old-growth forests that are present, as well as opportunities for management of those forests. The physiographic provinces form the basis of many terrestrial ecosystem analyses in the Forest Ecosystem Management Assessment Team report, and are used exclusively in tables of that report (Appendix A) as well as those in this SEIS.

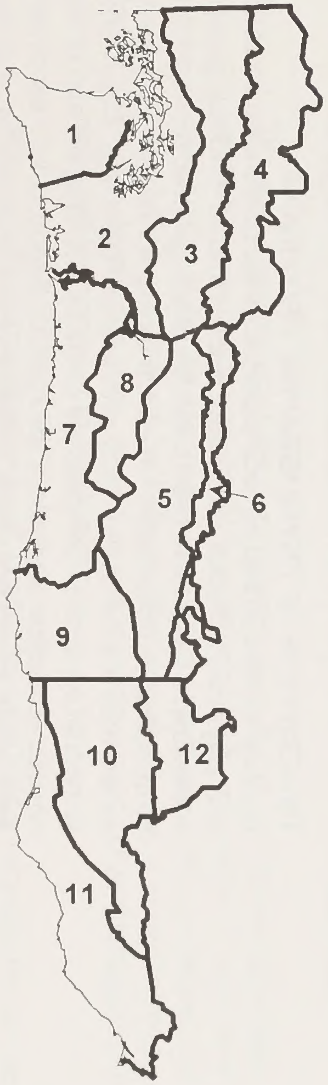
Both classifications of physiographic provinces (i.e., the terrestrial ecosystem-based and the aquatic ecosystem-based) are displayed in Figure 3&4 - 1 Physiographic Provinces. The aquatic ecosystem provinces are described below, and when appropriate, subprovince differences are also described. However, reference to the terrestrial ecosystem provinces should be made for interpretation of data tables, unless otherwise specified.

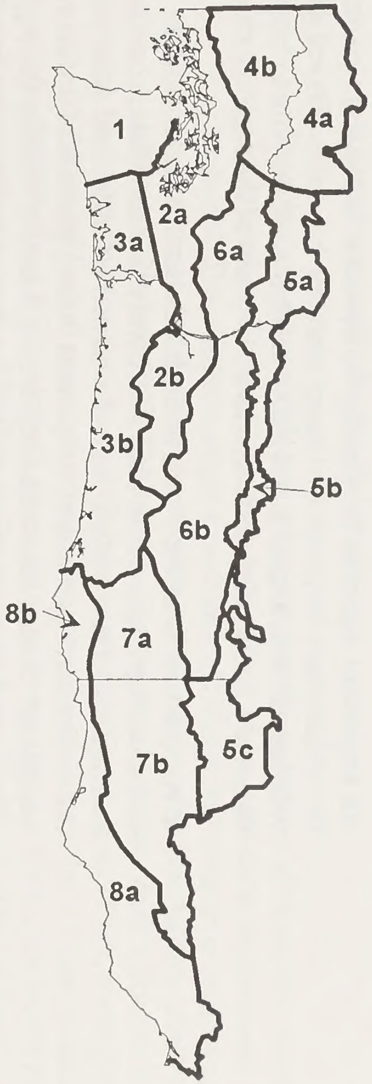
Figure 3&4-1 Physiographic Provinces.

## Physiographic Provinces

### Terrestrial Ecosystems Physiographic Provinces

1. WA Olympic Peninsula
2. WA Western Lowlands
3. WA Western Cascades
4. WA Eastern Cascades
5. OR Western Cascades
6. OR Eastern Cascades
7. OR Coast Range
8. OR Willamette Valley
9. OR Klamath
10. CA Klamath
11. CA Coast Range
12. CA Cascades





### Aquatic Ecosystems Physiographic Provinces

1. **Olympic Peninsula**
2. **Puget / Willamette Trough**
   - 2a. Western Washington Lowlands Subprovince
   - 2b. Willamette Valley Subprovince
3. **Washington/Oregon Coast Range**
   - 3a. Western Washington Lowlands Subprovince
   - 3b. Oregon Coast Range Subprovince
4. **North Cascades**
   - 4a. Eastern Washington Cascades Subprovince
   - 4b. Western Washington Cascades Subprovince
5. **High Cascades**
   - 5a. Eastern Washington Cascades Subprovince
   - 5b. Eastern Oregon Cascades Subprovince
   - 5c. Southern Cascades Subprovince
6. **Western Cascades**
   - 6a. Western Washington Cascades Subprovince
   - 6b. Western Oregon Cascades Subprovince
7. **Klamath / Siskiyou**
   - 7a. Oregon Klamath Subprovince
   - 7b. California Klamath Subprovince
8. **Franciscan**
   - 8a. California Coast Subprovince
   - 8b. Oregon Franciscan Subprovince

Precipitation enters the hydrologic system primarily as winter storms. The majority of the precipitation falls as snow in the higher elevations, while in the lower elevations it falls in the form of rain. Condensation drip is an important source of moisture in the middle elevations and in the coastal provinces. The amount of precipitation increases in a gradient from the south to north and from the coast to the interior. The southern provinces have a typical Mediterranean climate of mild, wet winters, with warm dry summers, while the northernmost provinces have much wetter climates and cooler summers. Provinces east of the Cascade Range have a more continental climate, with colder, drier winters, broken by late-summer monsoonal rains.

Stream and riparian habitat conditions vary greatly across the range of the northern spotted owl due to both natural and management-related factors. The type and structure of streamside vegetation reflects both climate and the disturbance regime of the area, determined by hydrology, geologic agents, and other processes such as forest fires. Many of these components of landscape form and function occur in distinctive combinations characteristic to each physiographic province in the region.

An important aspect of the Pacific Northwest riverine and riparian environment is the widespread occurrence of steep, unstable hillslopes. Recent geologic uplift, weathered rocks and soil, and heavy rainfall all contribute to high landslide frequency and to high sediment loads in many of the region's rivers.

In comparison with the coasts of British Columbia and southeast Alaska, the region of the northern spotted owl has a relatively low shoreline/coastline ratio. As a consequence, there are few well-developed estuaries and other nearshore rearing areas which are particularly important during periods of unfavorable ocean conditions. Because these rearing areas are limited, fish in the region of the northern spotted owl are more dependent on freshwater habitat than in adjacent areas.

### DESCRIPTION OF PHYSIOGRAPHIC PROVINCES

Because terrestrial and aquatic ecosystems are dominated by different biological and physical processes, the aquatic and terrestrial working groups of the Assessment Team have used different physiographic province boundaries. State administrative boundaries have been incorporated into the provinces to reflect differences in land use in many previous analyses (e.g., USDI 1992) and in the terrestrial ecosystem components of the FEMAT Report and in this SEIS. The aquatic ecosystem analysis of the FEMAT Report used a set of eight physiographic geoclimatic provinces which integrate physical processes, and used 15 "subprovinces" to delineate differences in administrative units, to account for differences in current climate, soil development, ecosystem processes, and for clarity.

#### Olympic Peninsula Province

The Olympic Peninsula in northwestern Washington is a mountainous region isolated on three sides by water and on the fourth side by an extensive region of cutover state and private lands (the Western Washington Lowlands). Streams flow outward from a central core of rugged mountains onto gently sloping lowlands. Landforms have been influenced by glaciation; main rivers flow in broad, U-shaped valleys. Steep slopes developed on resistant rocks are subject to narrow, shallow rapid landslides (debris flows) originating from the heads of stream channels.

Debris flows commonly scour steep tributary streams and deposit debris in fans on the valley floors. Unconsolidated glacial deposits are subject to stream bank erosion and landslides, and are susceptible to increased peak flows.

Vegetation and climate on the peninsula include a mixture of coniferous rain forests on the western slopes of the Olympic Mountains and relatively dry Douglas-fir forests in the rain shadow on the eastern slopes. This region is home to many species associated with late-successional and old-growth forests, including northern spotted owls, goshawks, marten and marbled murrelets. Although only a few nests have been found, large numbers of marbled murrelets are resident offshore and apparently nest on the peninsula. The dark, interior forest race of the northern goshawk occurs on the peninsula and may represent a unique subspecies.

The Olympic National Park occupies the interior of the Olympic Peninsula. It is surrounded by the Olympic National Forest, which is surrounded by extensive areas of private land, Indian reservations, and state managed lands. Much of the Olympic National Park consists of high-elevation forests and subalpine areas. However, lowland valleys within the park contain significant areas of late-successional and old-growth forest.

The Olympic National Forest is fragmented by a mixture of clearcuts, young plantations, and natural forests ranging from young stands to stands more than 500 years old. The southern edge of the National Forest includes an extensive area referred to as the "Shelton Sustained Yield Unit," which was largely clearcut between 1960 and 1985. The National Forest also includes small wilderness areas on the east slope of the Olympic Range adjacent to the National Park. Most private, state, and Indian reservation lands on the peninsula have been clearcut within the last 80 years. Some of these areas are now being clearcut for the second time. This province has one of the lowest fire frequencies of Pacific Northwest forest ecosystems, however, blowdown is an important agent of disturbance.

## Puget/Willamette Trough Province

**WESTERN WASHINGTON LOWLANDS SUBPROVINCE** PUGET SOUND is a depressed, glaciated area that is now partially submerged. Unconsolidated deposits of alluvial and glacial materials are subject to stream bank erosion and landslides, and are susceptible to increased peak flows. This area also includes extensive agricultural and metropolitan areas, as well as major nesting, roosting and foraging habitat of the marbled murrelet in Washington.

**WILLAMETTE VALLEY SUBPROVINCE** The Willamette Valley includes the lowland valley area between the Oregon Coast Range Subprovince and the Western Cascades Province in western Oregon. The Province includes a broad structural depression between the Coast Range and Cascade Range. The Willamette River meanders northward along a very gently sloping valley. Unconsolidated deposits of alluvial and glacial outwash materials are subject to accelerated stream bank erosion and landslides. This area, which was originally covered by of a mosaic of lowland coniferous and deciduous forests and native prairie grasslands, was mostly cleared in the 1800's and early 1900's and converted to farmland, residential areas and metropolitan areas. Land ownership is largely private. There is relatively little federally managed land within the Willamette Valley Subprovince, and only small fragments of these lands contain late-successional forests.

## North Cascades Province

**Western Washington Cascades Subprovince and Eastern Washington Subprovince** The North Cascades Province includes both the western and eastern slopes of the northern half of the Cascade Range in Washington. The Province exhibits extremely high relief in comparison to other provinces. Glaciers have carved deep and steep-sided valleys into both resistant and weak rocks. Tributary channels flow at high angles into rivers occupying broad glaciated valleys such as that occupied by Lake Chelan. Steep slopes are subject to debris flows from the heads of stream channels. Unconsolidated glacial and volcanic deposits are subject to accelerated stream bank erosion and landslides.

Lower and middle elevation forests of the Western Washington Cascades Subprovince consist primarily of Douglas-fir and western hemlock. The higher elevations are dominated by forests of silver fir and mountain hemlock. Although some National Parks and wilderness areas within this region include significant areas of mid-elevation late-successional and old-growth forest, most are dominated by high elevation areas of alpine or subalpine vegetation. The Eastern Washington Cascades Subprovince is dominated by mixed-conifer forests and ponderosa pine forests at mid to lower elevations and by true fir forests at higher elevations.

Land ownership and administration patterns include a mixture of Forest Service and National Park Service lands, tribal lands, and some state and private lands. Forests in the Eastern Washington Cascades Subprovince are highly fragmented due to a variety of natural factors (e.g., poor soils, high fire frequencies, and high elevations).

Before the advent of fire suppression in the early 1900's, wildfires played a major role in shaping the forests of the Eastern Washington Subprovince. Intensive fire suppression efforts in the last 60 years have resulted in significant fuel accumulations in some areas and shifts in tree species composition. These changes may have made forests more susceptible to large, high severity fires and to epidemic attacks of insects and diseases. Management plans for late-successional and old-growth forests in this area must include considerable attention to fire management and the stability of forest stands. However, fire frequencies in the Western Washington Subprovince are among the lowest in the range of the northern spotted owl.

## High Cascades Province

The High Cascades Province consists of volcanic landforms with varying degrees of glaciation. Lava flows form relatively stable plateaus, capped by the recent Cascade Range volcanoes. Drainages are generally not yet well developed, and precipitation and snowmelt disperse into highly permeable volcanic deposits. Geologically recent volcanic deposits are subject to large debris flows when saturated by snowmelt.

**Eastern Washington Cascades Subprovince and Eastern Oregon Cascades Subprovince** This area is dominated by mixed-conifer forests and ponderosa pine forests at mid to lower elevations and by true fir and mountain hemlock forests at higher elevations. Although some National Parks and wilderness areas within this region include significant areas of mid-elevation late-successional and old-growth forest, most are dominated by high elevation areas of alpine or subalpine vegetation and rock and ice.

Land ownership patterns include a mixture of Forest Service, National Park Service and Bureau of Land Management administered lands, as well as private, state, and tribal lands. Forests in this region are highly fragmented due to a variety of natural factors (e.g., poor soils, high fire frequencies, and high elevations) and human-induced factors (i.e., clearcutting and selective harvest).

Before the advent of fire suppression in the early 1900's, wildfires played a major role in shaping the forests of this region. Intensive fire suppression efforts in the last 60 years have resulted in significant fuel accumulations in some areas and shifts in tree species composition. These changes may have made forests more susceptible to large, high severity fires and to epidemic attacks of insects and diseases. Management plans for late-successional and old-growth forests in these subprovinces must include considerable attention to fire management and to the stability of forest stands.

**CALIFORNIA CASCADES SUBPROVINCE** The California Cascades Subprovince includes the extreme southern end of the Cascades Range. Forests in this region are dominated by mixed conifer or ponderosa pine associations on relatively dry sites. Ownership is mixed with some areas of consolidated Forest Service administered lands and some areas of intermixed Forest Service and private lands. Forests are highly fragmented due to natural factors and harvest activities.

As in a number of other provinces, fire plays an important role in the California Cascades in maintaining fire-adapted pine communities. Because of modern fire suppression, mixed-conifer communities have increased, gradually replacing pine-dominated stands. Management of fire-dependent old-growth forests has evolved to include understory thinning and understory burning, both of which are likely to increase on all lands in the future.

## Western Cascades Province

The Western Cascades are distinguished from the High Cascades by older volcanic activity and longer glacial history. Ridge crests at generally similar elevations are separated by steep, deeply dissected valleys. Complex eruption materials juxtapose relatively stable lava flows and volcanic deposits that weather to thick soils and are subject to large, slow-moving landslides (earthflows). Unconsolidated alluvial and glacial deposits are subject to stream bank erosion and landslides and are susceptible to increased peak flows. Tributary channels flow at large angles into wide, glaciated valleys. This region is dominated by humid forests of Douglas-fir and western hemlock, although these forests are considerably drier at the southern portion of the Province.

**WESTERN WASHINGTON CASCADES SUBPROVINCE AND WESTERN OREGON CASCADES SUBPROVINCE** Forests of these subprovinces consist primarily of Douglas-fir and western hemlock at lower to middle elevations, and of silver fir and mountain hemlock at higher elevations. Land ownership and administration includes a mixture of National Forests, and private and state lands. The Bureau of Land Management manages extensive holdings in the Western Oregon Cascades Subprovince. Private and state lands within this area are mostly cutover, whereas lands administered by the Forest Service and the Bureau of Land Management still include numerous (albeit highly fragmented) areas of late-successional and old-growth forest. At the southern end of the Western Oregon Cascades Subprovince, forests of Douglas-fir and western hemlock are largely replaced by mixed-conifer forests of Douglas-fir, grand fir and incense cedar.

A large proportion of the known northern spotted owl population and its habitat in Washington and Oregon occurs in the Western Cascades. In Washington, old-growth forests on National Forests in the Western Cascades are also important nesting habitat for marbled murrelets.

## Washington/Oregon Coast Range Province

The southern part of the province generally consists of steep slopes with narrow ridges developed on resistant sedimentary rocks. Westward flowing streams erode headward to mountain passes on the east side of the Coast Range. Many of the higher peaks are composed of resistant igneous rocks. Steep, highly dissected slopes are subject to debris flows. Tributary channels join at relatively low angles, which allow debris flows to travel for long distances. In the area drained by the Wilson and Trask Rivers in Oregon, weaker rocks form gentle slopes with thick soils that are subject to large, thick, slow-moving landslides (earthflows). Earthflows may constrict or deflect stream channels, creating local low-gradient stream reaches upstream.

**WESTERN WASHINGTON LOWLANDS SUBPROVINCE** The coastal section of the Western Washington Lowlands Subprovince includes the Willapa Hills. This area is largely in state and private ownership and has been almost entirely clearcut within the last 80 years. It is now dominated by a mixture of recent clearcuts and young stands on cutover areas. Forests on cutover areas are dominated by even-aged mixtures of Douglas-fir, western hemlock and red alder. The Western Washington Lowlands includes a major portion of the nesting, roosting, and foraging habitat of the marbled murrelet in Washington.

**OREGON COAST RANGE SUBPROVINCE** The subprovince includes the coastal mountains of western Oregon, from the Columbia River south to the Middle Fork of the Coquille River. This area is dominated by forests of Douglas-fir, western hemlock and western redcedar. The southern half of the subprovince includes a mixture of private lands and federally administered lands. The northern half is largely in private and state ownership. Heavy cutting and several extensive wildfires during the last century have eliminated most old-growth forests in the northern end of the province. Older forests in the southern half of the province are highly fragmented, especially on lands administered by the Bureau of Land Management, which are typically intermixed with harvested private lands in a checkerboard pattern of alternating square-mile sections.

Before the advent of fire suppression, the subprovince was subject to relatively infrequent, but very large fires, especially in the 1800's and 1900's. As a result, many of the remaining natural forests consist of a mosaic of mature stands and remnant patches of old-growth trees. Because it is isolated and large areas have been harvested, the Oregon Coast Range Subprovince is of concern for northern spotted owls, marbled murrelets, and anadromous fish.

## Klamath/Siskiyou Province

The Klamath/Siskiyou Province includes much of southwestern Oregon and northwestern California. The province is rugged and deeply dissected. Tributary streams generally follow the northeast-southwest orientation of rock structure created by accretion of rocks onto the continent. Variable soil and rock materials juxtapose steep slopes subject to debris flows and gentle slopes subject to earthflows. Scattered granitic rocks are subject to debris flows and severe surface erosion. High rates of uplift have created steep streamside hillslopes known as inner gorges, especially near the coast. Hillslope and channel disturbance due to mining activities began in the 1850's and still continues.

**OREGON KLAMATH SUBPROVINCE AND CALIFORNIA KLAMATH SUBPROVINCE** This area is dominated by mixed conifer and mixed conifer/hardwood forests. Land ownerships include a mixture of public lands administered by the Forest Service and the Bureau of Land Management, those administered by the states, and private landowners. Forests are highly fragmented by natural factors (e.g., poor soils, dry climate, and wildfires) and human-induced factors (e.g., harvest and roads). Much of the historical harvest in this area has been selective cutting rather than clearcutting. As a result, many stands that were logged in the early 1900's include a mixture of old trees left after harvest and younger trees that regenerated after harvest.

Much of the area within the subprovince is characterized by high fire frequencies. Any management plan for the late-successional and old-growth forests in these areas must include careful consideration of fire management.

**EAST KLAMATH/SISKIYOU SUBPROVINCE** Climatic and vegetation gradients, as reflected in the Bureau of Land Management's Grants Pass Line (Appendix B), and in the FEMAT Report (Appendix A), indicate that this additional subprovince be subdivided from the Oregon Klamath Subprovince. This subprovince is locally recognized by the Forest Service. The precise boundaries of the subprovince have not yet been defined, so it has not been incorporated into this Draft SEIS.

### Franciscan Province

**CALIFORNIA COAST RANGE SUBPROVINCE AND OREGON FRANCISCAN SUBPROVINCE** The Oregon Franciscan Subprovince includes a coastal strip that extends from south of Coos Bay to the Oregon and California border. Geologic and climatic factors indicated that this area be subdivided from the Oregon Klamath Subprovince. The California Coast Range Subprovince includes the coastal strip that extends from the Oregon border south to Marin County, California.

The Franciscan Province was formed by accretion of rocks onto the continent. Stream channels generally follow the northwest-southeast orientation of these rocks. Relatively rapid tectonic uplift has caused hillslopes to become highly dissected and incised by stream channels, creating inner gorges. Weak rocks are highly fractured along numerous faults and contacts, and are weathered to deep soils that are subject to extensive earthflows. Sediment yield is among the highest in the world.

This area is dominated by redwood forests and mixed forests of Douglas-fir and hardwoods. Most of the area is privately owned, but lands administered by the Forest Service and the Bureau of Land Management, as well as state and National Parks, are also present. This area includes the coastal fog belt in which grow the last remaining stands of old-growth redwoods. Considerable numbers of northern spotted owls occur on private lands in the area, as well as on federally managed and administered lands. In addition, this is an important nesting area for marbled murrelets.

# TERRESTRIAL AND AQUATIC ECOSYSTEMS

## Affected Environment

### CURRENT FOREST CONDITIONS WITHIN THE RANGE OF THE NORTHERN SPOTTED OWL

### Land Area and Ownership

The range of the northern spotted owl encompasses 57 million acres in the United States, of which 24.3 million acres (43 percent) are federally managed. Of the federally managed lands, 19.4 million acres are administered by the Forest Service, 2.7 million acres are administered by the Bureau of Land Management, and 2 million acres are administered by the National Park Service (Table IV-1). Other federally managed lands within the range of the northern spotted owl include military installations and national wildlife refuges.

Lands administered by the Forest Service are widely distributed within the range of the northern spotted owl. In contrast, lands administered by the Bureau of Land Management within the range of the owl are largely concentrated in western Oregon. Because of historical land grants, lands administered by the BLM in western Oregon tend to be distributed in a checkerboard pattern of alternating square-mile sections of Federal and private land.

Nonfederal lands within the range of the owl include a variety of privately owned lands and areas owned and administered by state governments. Indian reservations cover large portions of the range of the owl, especially in the Olympic Peninsula, Eastern Cascades, and Klamath Provinces. Private lands include a multitude of small holdings and extensive areas owned by large forest products companies.

### Allocation of Federal Lands

Federal lands within the range of the owl include 20.5 million acres that are considered capable of growing forests (see Appendix A, Terrestrial Forest Ecosystem Assessment). The other 3.8 million acres of Federal land include high elevation non-forested areas (e.g., meadows, shrublands, and lakes) and other nonforest types (e.g., roads). Of the 20.5 million forest acres on Federal lands, 5.7 million (28 percent) are in Congressionally Reserved Areas, primarily Wilderness and National Parks. Another 3.3 million acres (16 percent) are Administratively Withdrawn Areas, set aside by the managing agencies. Administrative withdrawals occur for a variety of reasons, including protection of fragile soils or watersheds, protection of wildlife or fish, recreation values, and scenic values. Administratively Withdrawn Areas are not necessarily off limits to timber harvest, however, no regular timber harvest is *scheduled* for these areas, and they do not contribute to estimates of allowable sale quantity (ASQ). These administrative withdrawals are subject to modification when agencies revise their management plans.

### Amounts of Late-Successional Conifer Forest on Federal Lands

Vegetation on Federal lands within the range of the northern spotted owl was categorized into broad structural types based on stand-based inventory data and satellite imagery (see Appendix A, Overview and Summary of Options and their Evaluation, and Terrestrial Forest Ecosystem Assessment). These structural classes are:

> Small conifer—This youngest seral category includes stands of trees generally less than 21 inches and ranging down to 9 inches diameter at breast height. A minority of the stands in this category have scattered large overstory trees that provide late-successional forest characteristics.

**Table IV-1.** Estimated total land acres within the range of the northern spotted owl by agency or ownership and physiographic province.

| State/ Physiographic province | Acres by ownership | | | | |
|---|---|---|---|---|---|
| | U.S. Forest Service | Bureau of Land Management * | National Park Service | Other federal | Non-federal |
| **Washington** | | | | | |
| Eastern Cascades | 3,329,000 | 0 | 137,200 | 6,000 | 2,210,000 |
| Western Cascades | 2,957,000 | 0 | 760,200 | 4,400 | 2,428,300 |
| Western Lowlands | 0 | 0 | 1,700 | 124,700 | 6,343,900 |
| Olympic Peninsula | 628,000 | 0 | 889,400 | 1,500 | 1,512,200 |
| **Total:** | **6,914,000** | **0** | **1,788,500** | **136,600** | **12,494,900** |
| **Oregon** | | | | | |
| Klamath | 1,284,800 | 821,200 | 200 | 0 | 1,894,200 |
| Eastern Cascades | 1,431,800 | 48,400 | 77,200 | 100 | 767,500 |
| Western Cascades | 3,724,600 | 666,300 | 86,800 | 500 | 2,161,700 |
| Coast Range | 618,600 | 776,300 | 100 | 1,700 | 4,374,400 |
| Willamette Valley | 0 | 16,800 | 0 | 8,700 | 2,632,600 |
| **Total:** | **7,059,800** | **2,329,000** | **164,300** | **11,000** | **11,830,400** |
| **California** | | | | | |
| Coast Range | 70,100 | 219,900 | 77,500 | 20,600 | 5,302,300 |
| Klamath | 4,358,200 | 101,600 | 0 | 0 | 1,621,100 |
| Cascades | 998,500 | 10,400 | 0 | 0 | 1,493,300 |
| **Total:** | **5,426,800** | **331,900** | **77,500** | **20,600** | **8,416,700** |
| **Three-State Total:** | **19,400,600** | **2,660,900** | **2,030,300** | **168,200** | **32,742,000** |

* No acres tallied for Bureau of Land Management in Washington due to the dispersed nature of the ownership

> **Medium/large single-storied conifer**—Stands dominated by conifer trees that are 21 to 32 inches diameter at breast height, characterized by only a single canopy layer. These stands qualify as late-successional forest.
>
> **Medium/large multistoried conifer**—Stands dominated by conifer trees that are greater than 32 inches diameter at breast height, and characterized by two or more canopy layers. These stands would generally best fit the definition of old-growth forests.

Forests on Federal lands within the range of the northern spotted owl currently include approximately 4.5 million acres of multistoried, medium/large conifer forest, 4 million acres of single-storied medium/large coniferous forest, and 5.8 million acres of small, single story conifers (see Appendix A, Terrestrial Forest Ecosystem Assessment). It should be noted that the definition of "small" conifer forests includes some stands that are late-successional. Thus, the data cannot be used to develop a total acreage of late-successional forest.

Of the 8.5 million acres of medium/large conifer forest on federally administered lands within the range of the owl, 2.5 million acres (28.7 percent) are Congressionally Reserved Areas, and 1.6 million acres (19.1 percent) are Administratively Withdrawn Areas (Table IV-3). An undetermined proportion of the medium/large conifer forests in both Congressionally Reserved Areas and Administratively Withdrawn Areas are high-elevation forests that are not occupied by spotted owls (Table IV-4). Although the latter stand types may not be important to spotted owls, they are important habitat for a variety of plants and animals that occupy late-successional high-elevation forests.

Substantial portions of Congressionally Reserved Areas and Administratively Withdrawn Areas are covered by relatively young forest. Of the 5.7 million forest acres in Congressionally Reserved Areas, for example, 1.6 million acres (28.5 percent) are in single story stands of small conifers (see Appendix A, Terrestrial Forest Ecosystem Assessment). This does not include additional acres that are covered by forests of trees smaller than 9 inches in diameter. The considerable acreage of small forests within Congressionally Reserved Areas reflects a long history of fire and other natural disturbances as well as factors such as poor soils and high elevations, which tend to suppress tree growth.

### Patterns of Spatial Distribution

As described in the earlier descriptions of regional provinces, most late-successional and old-growth forests within the range of the spotted owl have been removed from private and state lands. Late-successional stands that remain on private and state lands tend to occur in small islands, surrounded by cutover areas and young stands. In areas where little Federal land is present, such as the western Washington lowlands, old-growth forests have been largely eliminated by harvest and settlement.

On Federal lands, old-growth forests tend to be distributed in a highly fragmented mosaic, often intermixed with recently harvested areas and stands of younger trees. Late-successional and old-growth forests in Congressionally Reserved Areas tend to occur in larger blocks than nonreserve areas, but even in these areas there is considerable natural fragmentation of older stands due to historic disturbance patterns and poor growth conditions.

**Table IV-3.** Current estimated late-successional conifer forest on federal lands in the range of the northern spotted owl by total acres, acres in Congressionally Withdrawn Areas, and acres in Administratively Withdrawn Areas by state and physiographic province.

| State/ Physiographic province | Total | | | Portion in Congressionally Withdrawn Areas | | | Portion in Administratively Withdrawn Areas | | |
|---|---|---|---|---|---|---|---|---|---|
| | Small conifer single story * | Medium/large conifer ** Single story | Medium/large conifer ** Multi-story | Small conifer single story * | Medium/large conifer ** Single story | Medium/large conifer ** Multi-story | Small conifer single story * | Medium/large conifer ** Single story | Medium/large conifer ** Multi-story |
| **Washington** | | | | | | | | | |
| Eastern Cascades | 830,100 | 515,500 | 432,200 | 286,000 | 183,700 | 217,700 | 164,400 | 74,600 | 68,600 |
| Western Cascades | 1,009,000 | 676,000 | 515,700 | 373,000 | 309,600 | 209,000 | 175,500 | 112,800 | 143,900 |
| Western Lowlands | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Olympic Peninsula | 485,800 | 47,400 | 446,700 | 274,300 | 23,000 | 327,700 | 17,800 | 3,000 | 16,600 |
| **Total:** | **2,324,900** | **1,238,900** | **1,394,600** | **933,300** | **516,300** | **754,400** | **357,700** | **190,400** | **229,100** |
| **Oregon** | | | | | | | | | |
| Klamath | 596,200 | 207,500 | 489,500 | 98,100 | 19,400 | 50,900 | 104,400 | 30,500 | 75,700 |
| Eastern Cascades | 968,900 | 207,000 | 81,100 | 250,700 | 68,400 | 22,200 | 203,100 | 49,100 | 16,900 |
| Western Cascades | 1,165,100 | 997,900 | 921,200 | 279,400 | 231,900 | 102,200 | 189,900 | 125,200 | 122,600 |
| Coast Range | 526,100 | 209,300 | 140,500 | 18,900 | 2,600 | 400 | 19,400 | 9,700 | 10,900 |
| Willamette Valley | 4,300 | 1,300 | 800 | 0 | 0 | 0 | 0 | 0 | 100 |
| **Total:** | **3,260,600** | **1,623,000** | **1,633,100** | **647,100** | **322,300** | **175,700** | **516,800** | **214,500** | **226,200** |
| **California** | | | | | | | | | |
| Coast range | 4,700 | 25,800 | 9,800 | 300 | 2,700 | 2,200 | 2,100 | 9,600 | 3,800 |
| Klamath | 140,300 | 963,200 | 1,303,900 | 37,100 | 304,500 | 368,000 | 28,800 | 214,500 | 462,600 |
| Cascades | 38,500 | 181,500 | 157,100 | 1,800 | 4,700 | 0 | 1,400 | 40,100 | 34,400 |
| **Total:** | **183,500** | **1,170,500** | **1,470,800** | **39,200** | **311,900** | **370,200** | **32,300** | **264,200** | **500,800** |
| **Three-State Total:** | **5,769,000** | **4,032,400** | **4,498,500** | **1,619,600** | **1,150,500** | **1,300,300** | **906,800** | **669,100** | **956,100** |

* Stands generally characterized by trees 9.0 - 20.9 inches in diameter at breast height (dbh) - only a portion of these acres are late-successional forest.

** Stands generally characterized by trees 21.0 inches in diameter at breast height (dbh) or larger

**Table IV-4.** Acres of conifer forest on federal lands within the range of the northern spotted owl, by structural class and 2,000 foot elevation band.

| State | Class [a] | *Elevation bands in thousands of feet* | | | | | *Grand total* |
|---|---|---|---|---|---|---|---|
| | | *0-2* | *2-4* | *4-6* | *6-8* | *8-16* | |
| California | Small Conifer | 1,107 | 53,115 | 92,635 | 35,766 | 830 | 183,452 |
| | Med/Lrg Single Story Conifer | 38,651 | 373,899 | 593,551 | 161,755 | 2,648 | 1,170,503 |
| | Med/Lrg Multi Story Conifer | 63,074 | 547,075 | 612,955 | 243,996 | 3,636 | 1,470,737 |
| Oregon | Small Conifer | 594,183 | 1,060,440 | 1,124,502 | 479,338 | 2,134 | 3,260,598 |
| | Med/Lrg Single Story Conifer | 228,347 | 665,003 | 559,959 | 169,541 | 40 | 1,622,889 |
| | Med/Lrg Multi Story Conifer | 261,939 | 784,828 | 523,403 | 62,837 | 40 | 1,633,045 |
| Washington | Small Conifer | 191,079 | 1,009,064 | 902,202 | 222,458 | 79 | 2,324,883 |
| | Med/Lrg Single Story Conifer | 33,750 | 435,668 | 692,746 | 76,669 | 0 | 1,238,833 |
| | Med/Lrg Multi Story Conifer | 147,252 | 593,195 | 618,172 | 36,042 | 0 | 1,394,661 |
| 3 State Total | Small Conifer | 786,369 | 2,122,619 | 2,119,339 | 737,562 | 3,043 | 5,768,932 |
| | Med/Lrg Single Story Conifer | 300,747 | 1,474,570 | 1,846,256 | 407,965 | 2,687 | 4,032,226 |
| | Med/Lrg Multi Story Conifer | 472,264 | 1,925,098 | 1,754,530 | 342,876 | 3,675 | 4,498,443 |

[a] **Small Conifer** - Stands dominated by small conifer trees ranging from 9 to 21 inches diameter at breast height.
**Medium/large single storied conifer** - Stands dominated by conifer trees that are at least 21 inches in diameter at breast height, and characterized by only a single canopy layer.
**Medium/large multistoried conifer** - Stands dominated by conifer trees that are at least 21 inches diameter at breast height, and characterized by a multistoried canopy.

## Management Considerations

**Retention of Old-Growth Fragments** Old-growth fragments can sometimes serve as the only source in a landscape of many lichens, fungi, bryophytes, plants, and small-bodied animals that contribute to biodiversity and productivity of the forest ecosystem. Old-growth fragments may be critical for species that are locally endemic, occur only in very specific conditions of forest structure or soil, or have limited dispersal capabilities.

Arthropods, fungi, lichens, bryophytes, vascular plants, and invertebrate animals inhabit much smaller patches of old-growth forest and may persist in such patches for a much longer time than vertebrates. Patches of old-growth forests 25 acres or less may provide habitat for a wide variety of these organisms even though edge effects may eliminate fully buffered core habitat (D. Olson, pers. comm.). Although some highly sensitive arthropod species may be eliminated in very small fragments of old growth, many less sensitive species may continue to inhabit the patch. Thus, patch size and potential edge effects alone should not exclude small, old-growth fragments from management consideration. Recent studies by Chen et al. (1990) suggest that buffers of 300 to 800 feet provide interior habitat conditions for vascular plants. According to Harris (1984), a circular stand of old growth with a radius of 600 feet (26 acres) provides minimal interior conditions, provided the patch is surrounded by at least young forests.

Small fragments can be important for pollen vectors and animals that disperse plant seeds. Mycotrophic plant species have symbiotic relationships with fungi and photosynthetic vascular plants, and may require seed dissemination by animals whose diets include fungi (Luoma, pers. comm.). Small fragments may also contribute to the persistence of small animal populations, particularly invertebrates.

Survival of most conifers and flowering plants depends on mycorrhizal associations with fungi for uptake of nutrients and water. Nearly 2,000 mycorrhizal species are associated with Douglas-fir alone (Trappe 1977); species diversity provides seasonal and long-term resilience to the forest (Molina et al. 1992). Small fragments of old-growth forest may provide a source of inoculum for fungi dispersal into adjacent managed stands.

Many arboreal mosses and lichens can persist in small patches of older trees. These species have limited dispersal capability, and spread slowly from such patches. In England, Rose (1988) found that some lichen species persisted in small patches of old-growth forest that had undergone centuries of selective harvest, but were absent in secondary forests regrown after regeneration harvests. In fact, lichen species have been used to index the degree of historical continuity of forest cover of some woodlands (Broad 1989). Some lichens, particularly nitrogen-fixing species, do not become established until stands are several hundred years old (McCune 1993).

Small fragments of old growth may act as refugia or centers of dispersal for many organisms including plants, fungi, lichens (Esseen et al. 1992), and arthropods. Arthropods are key to ecosystem function and can serve as indicators of forest health (Lattin 1990, Moldenke 1990, Moldenke and Lattin 1990), yet very little is known about the mobility of most species. Isolating a patch of old-growth forest may isolate the arthropod fauna, especially those that are flightless or associated with the soil litter. However, small old-growth fragments may also serve as refugia for arthropods as long as mesic microhabitats are present. Arthropods that might persist in small fragments include predators that help control insect populations that otherwise might damage foliage in surrounding younger stands. Successful dispersal of some arthropods is dependent on mesic habitats between the patches of old-growth, as well as closed-canopy patches of trees and riparian forests.

Organisms that have the greatest difficulty moving between old-growth patches are understory specialists, usually flightless forms or those with limited dispersal mechanisms. Many insect groups associated with old-growth forests are flightless, especially those found on the forest floor. Distances of 66 feet or less of unsuitable habitat could act as dispersal barriers to some understory invertebrate specialists, including species of bees, wasps, moths, beetles, and millipedes. Roads can act as barriers to these organisms. These species are likely to be poor dispersers, have restricted habitat requirements, and occur in limited geographic ranges. Many are also sensitive to differences in humidity, soil moisture, and temperature beyond the edge of an old-growth fragment. The amphibians and mollusks have low mobility, specific habitat requirements, and depend on moist environments for at least parts of their life cycle. There is considerable genetic variability among and within species of amphibians. This high degree of variability is probably a result of their specific habitat associations and limited mobility.

Plant populations that have had limited opportunity to interbreed may also become genetically and morphologically distinct. Particularly important are isolated, disjunct populations (e.g., Coptis asplenifolia). However, artificially limiting the amount of gene exchange in highly-fragmented landscapes may reduce persistence.

Plants with limited dispersal capabilities (e.g., those with ephemeral seeds) may be particularly vulnerable to isolation. Small fragments can serve as genetic reserves for recolonization of adjacent habitat.

Small patches of old-growth forest can provide thermal and mesic refugia for a variety of organisms. Understory habitats in old-growth forests can escape freezing conditions due to the thermal buffering of dense tree canopies. Deer and other vertebrates may rely on these thermal refuges during harsh storms or during dispersal to larger stands of suitable habitat. Many invertebrates migrate locally to mesic refugia during summer. During very dry periods in eastern forests, many invertebrates may require dense forest cover and mesic understory habitats to avoid desiccation. This has been shown to be the case for many tropical invertebrates (D. Olson, pers. comm.) and mollusks in the Pacific Northwest (Frest and Johannes 1993). Similarly, during hot, dry summers, large woody debris in old-growth fragments provide sites for truffle production, while truffle production in plantations do not occur until after the fall rains have increased soil moisture (Amaranthus and Trappe, pers. comm.). Mature forest fragments provide food, such as, truffles, for small mammals like red-backed voles during the dry summer months when such food is unavailable in plantations. Invertebrates and some mammals may rely on food resources that are absent or rare in young forests during stressful periods. Deer and small mammals such as flying squirrels often rely on lichens in old-growth forests for food during harsh winter weather when other food types are unavailable (Hodgman and Bowyer 1985).

Lower elevation forests have been subject to more intensive forest management than higher elevation forests because a large proportion of lands at low elevation are privately owned. Small fragments of old growth are the only remaining representatives of low elevation forests in some areas. Some ecosystems are infrequently found on Federal lands, particularly low elevation old-growth forests, but also deciduous forests and grasslands.

Old-growth forest fragments may be very important to rare and geographically restricted species of mollusks, fungi, lichens, and vascular plants. Among species evaluated for viability by the Assessment Team, rare and locally distributed species comprised 28 percent of the fungi, and 26 percent of the vascular plant species. Designated areas may provide limited protection to these species, depending on their distribution.

## STAND FEATURES

**Green Trees and Dead Wood in the Matrix** Residual green trees and dead wood in harvested areas of the matrix bridge past and future forests. Green trees serve several important functions including snag recruitment, promoting multistoried canopies, providing shade and suitable habitat for many organisms in the matrix, and serving as refugia and centers of dispersal.

Patches of green trees of various sizes, ages, and species will promote species diversity of fungi, lichens, plants, and arthropods. Single leave trees exist in a less protected microclimate than trees in small patches. Many fungi, plants, and arthropods require moist, cool microclimates and do not tolerate exposed conditions.

Complex canopy structure (especially leaning boles) are beneficial for some lichens, such as pin lichens (Calcium spp.)(Esseen et al. 1992). Trees that are asymmetrical promote a diversity of habitat substrates, and often have more lichen and moss epiphytes on large lateral limbs than symmetrical trees. Location of green trees is also important; for example, ridgelines are optimum locations for lichen dispersal.

Large green trees, snags, and large woody debris are important for many animals. Thomas (1979) found that 178 vertebrates—14 amphibians and reptiles, 115 birds, and 49 mammals—used down logs as habitats in northeast Oregon forests. Resting sites for American martens and fishers include inside cavities and hollow stumps, and under logs. Large old trees, snags, and logs that provide protection from predators and thermal protection are used as natal den sites.
Adequate numbers of large snags and green trees are critical for bats because they are used for maternity roosts, temporary night roosts, day roosts, and hibernaculas. Also, bats compete with primary excavators and other species that use cavitit roosts are often located at different sites, and migrating bats may roost under bark in small groups. Thermal stability within a roost site is important for bats; large snags and green trees provide this stability. Individual bat colonies may use several roosts during a season as temperature and weather conditions change. Large, down logs with loose bark may also be used by some bats for roosting, including Yuma myotis and little brown bats.

Two species of salamanders are closely associated with large woody debris: Oregon slender and clouded salamanders. While the degree to which seven other late-successional associated species of salamanders are dependent on large woody debris is not clear, all of these species will benefit substantially from the retention of large woody debris. This group includes three species of Pacific giant salamanders, Del Norte, Van Dyke's, western redback, and Ensatina salamanders.

Large woody debris is essential for many species of vascular plants, fungi, liverworts, mosses, and lichens. Truffle production (fruiting bodies of hypogeous fungi) was found to be highest in association with large woody debris in mature forests in southwestern Oregon (Amaranthus and Trappe, pers. comm.). This is probably related to the moisture-holding capacity of decayed wood in comparison to surrounding soil that dries and suppresses fruiting of fungi. Maintaining conditions that are favorable for fungi will promote the persistence of invertebrates that are fungivores. Saprobic fungi, such as conks or polypores, are common in mature forests because they grow on large woody debris. One lichen, *Cladonia norvegica*, needs large woody debris as a substrate. Some bryophytes (many liverworts and some mosses) need saturated logs in shaded environments to exist and will not survive desiccation for even short periods of time. Some vascular plants establish only on large decaying logs ("nurse logs") and others establish primarily on large woody debris (e.g., *Pyrola uniflora, Allotropa virgata*). Several species appear to be restricted to decaying wood substrates due to their symbiotic association with fungi. Most orchids and some heaths require specific fungi for germination and growth (Wells 1981, Furman and Trappe 1971). However, large woody debris in the matrix may be inferior habitat for these organisms compared to habitat within old-growth fragments, due to drier climatic conditions. Microclimate, log decay processes, and fungal associations may be altered by removal of canopy cover. Logs in the matrix will be occupied by different species than those found on large woody debris in an old-growth fragment.

Arthropods associated with decayed wood include wood-boring beetles, carpenter ants, and termites. Many unusual arthropods such as a relic wood-eating roach, *Crypotcercus* (Lattin pers. comm.), are associated with large decayed logs. Many beetles (including Buprestidae, Carabidae, Curculionidae, and Scolytidae) attack freshly killed trees and play an important role in exposing down logs to decomposition. Other arthropod groups associated with large woody debris include detritivores, fungivores, predators, and parasitoids/parasites that are vital to the nutrient cycling process.

## CURRENT AQUATIC CONDITIONS

### Aquatic Ecosystems

Key physical components of a fully functioning aquatic ecosystem include complex habitats consisting of floodplains, banks, channel structure (i.e. pools and riffles), water column and subsurface waters. These are created and maintained by rocks, sediment, large wood, and favorable conditions of water quantity and quality. Upslope and riparian areas influence aquatic systems by supplying sediment, large wood and water. Disturbance processes such as landslides and floods are important delivery mechanisms. Over time scales of 1-100 years, streams are clearly disturbance dependent systems. To maintain community viability throughout a large drainage basin, it is necessary to maintain features of the natural disturbance regime (i.e., frequency duration, and magnitude) in different portions of a basin. Aquatic ecosystems consist of a diversity of species, populations and communities that may be uniquely adapted to these specific structures and processes.

Aquatic ecosystems in the range of the northern spotted owl exhibit signs of degradation and ecological stress. Recent studies have reported the loss or simplification of habitat in streams. Approximately 55 percent of the 27,000 stream miles examined statewide in Oregon on both Federal and nonfederal lands are either severely or moderately impacted by nonpoint source pollution. Over one third of Washington state's wetlands on all ownerships have been lost, and 90 percent of those remaining are considered degraded. Concern about aquatic ecosystems is elevated with the identification of large numbers of native freshwater and anadromous fish species and stocks that require special management considerations due to low or declining numbers.

Spatial and temporal connectivity within and between watersheds is important for maintaining aquatic and riparian ecosystem function. A large river basin can be visualized as a mosaic of terrestrial "patches" or smaller watersheds linked by stream, riparian, and sub-surface networks. Lateral, vertical, and drainage network linkages are critical to aquatic system function. Important connections within basins include linkages among headwater tributaries and downstream channels as paths for water, sediment, and disturbances; and linkages among floodplains, surface water, and ground water systems (hyporheic zones) as exchange areas for water, sediment and nutrients. Unobstructed physical and chemical paths to areas important for fulfilling life history requirements of aquatic and riparian-dependent species need to be maintained. Connections among basins allow for movement between refugia.

Maintaining the connectivity of all parts of the aquatic ecosystem is important for healthy watersheds and good fish habitat. First- and second-order streams, which generally include permanently flowing nonfish-bearing streams and seasonally flowing or intermittent streams, often comprise over 70 percent of the cumulative channel length in mountain watersheds in the Pacific Northwest. These streams are sources of water, nutrients, wood, and other vegetative material for streams inhabited by fish and other aquatic organisms. Decoupling the stream network may result in the disruption and loss of functions and processes necessary for creating and maintaining fish habitat.

## Habitat Components

HYDROLOGY Changes in hydrologic processes can be grouped into two classes according to the cause of the change. One class consists of changes resulting from removing forest vegetation through harvest. These changes, which can be very large close to the harvest area and immediately following harvest, gradually diminish over time as vegetation regrowth occurs. Processes that depend on the amount and size of forest vegetation include rain or snow interception, fog drip, transpiration, and snow accumulation and melt. These processes, most of which are at least partially energy-dependent, all increase the amount or timing of water arriving at the soil surface and the amount of water flowing from a logged watershed. The longevity of changes in these processes brought about by timber harvest generally is on the order of three to four decades and is related to vegetation characteristics such as tree height, leaf area, canopy density, and canopy closure.

A second class of changes in hydrologic processes consists of those that control infiltration and the flow of surface and subsurface water. This class is dominated by the effects of forest roads. The relatively impermeable surfaces of roads cause surface runoff that by-passes longer, slower subsurface flow routes. Where roads are insloped to a ditch, the ditch extends the drainage network, collects surface water from the road surface and subsurface water intercepted by roadcuts, and transports this water quickly to streams. The longevity of changes in hydrologic processes resulting from forest roads is as permanent as the road. Until a road is removed and natural drainage patterns are restored, the road will likely continue to affect the routing of water through watersheds.

In watersheds on the order of 20-200 square miles, increased peak flows have been detected after roading and clearcutting occurred. Higher flows result from a combination of wetter, more efficient water-transporting soils following reduced evapotranspiration, increased snow accumulation and subsequent melt during rainfall, surface runoff from roads, extension of drainage networks by roadside ditches, and possibly reduced roughness of stream channels following debris removal and salvage logging in riparian zones. The alteration in stream flow regime resulting from timber harvest and associated activities can have both positive and negative effects on the aquatic system.

WATER QUALITY High water quality is essential for survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities. Elements of water quality that are important for aquatic organisms include water temperatures within a range that corresponds with migration and emergence needs of fish and other aquatic organisms. Desired conditions include an abundance of cool (generally less than 68°F), well-oxygenated water that is present at all times of the year, free of excessive amounts of suspended sediments and other pollutants that could limit primary production and benthic invertebrate abundance.

Increased levels of sedimentation often have adverse effects on fish and habitats and riparian ecosystems. Fine sediment deposited in spawning gravels can reduce survival of eggs and developing alevins. Primary production, benthic invertebrate abundance, and thus, food availability for fish may be reduced as sediment levels increase. Social and feeding behavior can be disrupted by increased levels of suspended sediment. Pools, an important habitat type, may be lost due to increased levels of sediment.

Accelerated rates of erosion and sediment yield are a consequence of most forest management activities. Road networks in many upland areas of the Pacific Northwest are the most important sources of management-accelerated delivery of sediment to anadromous fish habitat. The sediment contribution to streams from roads is often much greater than that from all other land management activities combined, including log skidding and yarding. Road-related landsliding, surface erosion and stream channel diversions frequently deliver large quantities of sediment to streams, both chronically and catastrophically during large storms. Roads have unavoidable effects on streams, no matter how well they are located, designed or maintained. Many older roads with poor locations and inadequate drainage control and maintenance pose high risks to erosion and sedimentation of stream habitats.

Federal lands within the range of the northern spotted owl contain approximately 110,000 miles of roads (Table V-2). A substantial proportion of this network constitutes current and potential sources of damage to riparian and aquatic habitats, mostly through sedimentation. In general, the greater the density of roads, the greater the potential damage to the aquatic and riparian habitats.

Roads modify natural hillslope drainage networks and accelerate erosion processes. These changes can alter physical processes in streams, leading to changes in streamflow regimes, sediment transport and storage, channel bank and bed configurations, substrate composition, and stability of slopes adjacent to streams. These changes can have significant biological consequences that affect virtually all components of stream ecosystems.

Increased water temperature can often be traced to removal of shade-producing riparian vegetation along fish-bearing streams and along smaller tributary streams that supply cold water to fish-bearing streams. Removal of streambank vegetation has resulted largely from timber harvest in riparian areas.

The U.S. Environmental Protection Agency reporting the results of state 305(b) and 319 assessments found many streams on lands administered by the Forest Service and Bureau of Land Management in the range of the northern spotted owl to either be moderately or severely impacted by increases in water temperature and sedimentation. On Federal lands in Oregon, 55 percent (20,400 miles) of the streams are moderately or severely impaired. On lands administered by the Bureau of Land Management 7,300 miles of streams, and 4,900 miles of streams on lands administered by the Forest Service have water temperature problems. An additional 8,000 to 11,000 miles have problems with turbidity, erosion, and bank instability.

## Table V-2. Summary of road development on public lands in the range of the northern spotted owl

| National Forest or BLM District | Total Road Miles | ML 1 [1] Miles | Ml 1 % | ML 2 [2] Miles | ML 2 % | "Public" [3] Road Miles | Public Road % | Native Surface Miles | Native Surface % | Gross area minus wilderness (sq. mi.) | Net roaded area [4] (sq. mi.) | % of non-wilderness in roadless | Road Density (mi/sq. mi.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Deschutes NF | 8,722 | 469 | 5 | 7,535 | 86 | 718 | 8 | 7,009 | 80 | 2,179 | 2,009 | 8 | 4.34 |
| Mt. Hood NF | 3,818 | 443 | 12 | 2,236 | 59 | 1,139 | 30 | 845 | 22 | 1,428 | 1,211 | 15 | 3.15 |
| Rogue River NF | 2,782 | 90 | 3 | 1,830 | 66 | 862 | 31 | 1,055 | 38 | 837 | 711 | 15 | 3.92 |
| Siskiyou NF | 2,949 | 300 | 10 | 2,092 | 71 | 557 | 19 | 689 | 23 | 1,343 | 899 | 33 | 3.28 |
| Siuslaw NF | 2,540 | 220 | 9 | 1,625 | 64 | 695 | 27 | 115 | 5 | 910 | 868 | 5 | 2.92 |
| Umpqua NF | 4,880 | 1,276 | 26 | 2,447 | 50 | 1,157 | 24 | 1,132 | 23 | 1,498 | 1,325 | 12 | 3.68 |
| Willamette NF | 6,424 | 700 | 11 | 3,757 | 58 | 1,967 |  | 380 | 6 | 2,023 | 1,768 | 13 | 3.63 |
| Winema NF | 6,221 | 1,848 | 30 | 3,111 | 50 | 1,262 | 20 | 5,374 | 86 | 1,488 | 1,451 | 2 | 4.29 |
| Coos Bay BLM | 1,924 |  |  |  |  |  |  |  |  |  | 511 |  | 3.76 |
| Medford BLM | 5,628 |  |  |  |  |  |  |  |  |  | 1,436 |  | 3.92 |
| Eugene BLM | 1,935 |  |  |  |  |  |  |  |  |  | 492 |  | 3.94 |
| Roseburg BLM | 2,924 | Road maintenance level and surfacing data not available for BLM lands |  |  |  |  |  |  |  |  | 655 |  | 4.46 |
| Salem BLM | 2,636 |  |  |  |  |  |  |  |  |  | 622 |  | 4.23 |
| Arcata BLM | 135 |  |  |  |  |  |  |  |  |  | 277 |  | 0.49 |
| Redding BLM | 350 |  |  |  |  |  |  |  |  |  | 387 |  | 0.90 |
| Gifford-Pinchot NF | 4,341 | 569 | 13 | 2,777 | 64 | 995 | 23 | 719 | 17 | 1,861 | 1,525 | 18 | 2.85 |
| Mt. Baker-Snoqualmie | 2,988 | 615 | 21 | 968 | 32 | 1,405 | 47 | 94 | 3 | 1,565 | 934 | 40 | 3.20 |
| Okanogan NF | 2,665 | 477 | 18 | 1,158 | 43 | 1,030 | 39 | 1,615 | 61 | 1,688 | 1,226 | 27 | 2.17 |
| Olympic NF | 2,463 | 556 | 23 | 1,207 | 49 | 701 | 28 | 1,446 | 59 | 872 | 738 | 15 | 3.34 |
| Wenatchee NF | 5,069 | 840 | 17 | 3,214 | 63 | 1,015 | 20 | 3,362 | 66 | 2,067 | 1,198 | 42 | 4.23 |
| Klamath NF | 4,656 | 895 | 19 | 2,478 | 53 | 1,284 | 28 | 3,295 | 71 | 1,477 | 1,100 | 26 | 4.23 |
| Shasta-Trinity NF | 6,528 | 981 | 15 | 3,914 | 60 | 1,633 | 25 | 4,939 | 76 | 2,690 | 2,255 | 16 | 2.89 |
| Mendocino NF | 2,486 | 619 | 25 | 1,402 | 56 | 465 | 19 | 2,422 | 97 | 1477 | 1,255 | 16 | 1.10 |
| Six Rivers NF | 2,489 | 648 | 26 | 1,192 | 48 | 649 | 26 |  | 0 | 1,304 | 1,085 | 17 | 2.29 |
| **TOTALS** | 87,554 | 11,547 | 13 | 42,941 | 49 | 17,534 | 20 | 34,491 | 39 | 26,707 | 25,940 |  | 3.38 |
| adjusted by 1.25 [5] | 109,443 |  |  |  |  |  |  |  |  |  |  |  | 4.22 |

---

[1] ML 1 - Maintenance Level 1 are roads that are closed but still considered part of the transportation system.

[2] ML 2 - Maintenance Level 2 are roads suitable for high-clearance vehicles only.

[3] "Public" refers to roads that are designed and maintained for normal-clearance vehicles (FS Maintenance Levels 3, 4 & 5).

[4] Derived by subtracting Inventoried Roadless Area acreage from gross NF acreage without Wilderness.

[5] Estimated adjustment for non-system roads.

**Riparian** Riparian vegetation regulates the exchange of nutrients and material from upland forests to streams. Fully functional riparian ecosystems have the following characteristics. Large conifers or a mixture of large conifers and hardwoods are found in riparian zones along all streams in the watershed, including those not inhabited by fish. Riparian zone-stream interactions are assumed to be a major determinant of large woody debris loading. Stream temperatures and light levels which influence ecological processes are moderated by riparian vegetation. Streambanks are vegetated with shrubs and other low-growing woody vegetation. Root systems in streambanks of the active channel stabilize banks, allow development and maintenance of undercut banks, and protect banks during large stream flows. Riparian vegetation contributes leaves, twigs and other forms of fine litter that are an important component of the aquatic ecosystem food base.

Riparian areas are particularly dynamic portions of the landscape. These areas are shaped by disturbances characteristic of upland ecosystems, such as fire and windthrow, as well as disturbance processes unique to stream systems, such as lateral channel erosion, peakflow, deposition by floods, and debris flows. Near-stream floodplain riparian areas may have plant communities of relatively high diversity and extensive hydrologic and nutrient cycling interactions between groundwater and riparian vegetation.

Riparian areas are widely considered to be important wildlife habitat. A distinct microclimate is maintained along stream channels, created by cold air drainage and the presence of turbulent surface waters. Large wood on the ground is an important habitat component of riparian areas. Maintaining the integrity of the vegetation is particularly important for riparian-dependent organisms including amphibians, arthropods, mammals, birds, and bats.

Many effects of forests on streams decrease with increasing distance from the streambank (Figures V-12 and V-13) and are influenced by the degree of channel constraint or flood plain development.

**Large Wood** Large quantities of downed trees are a functionally important component of many streams. Large woody debris influences channel morphology by affecting longitudinal profile, pool formation, channel pattern and position, and channel geometry. Downstream transport rates of sediment and organic matter are controlled in part by storage of this material behind large wood. Large wood affects the formation and distribution of habitat units, provides cover and complexity, and acts as a substrate for biological activity. Wood enters streams inhabited by fish either directly from the adjacent riparian zone, from tributaries that may not be inhabited by fish, or hillslopes.

Large wood in streams has been reduced due to a variety of past and present timber harvesting practices and associated activities. Many riparian management areas on Federal lands are inadequate as long term sources of wood. Widths of intact riparian areas have been reduced by timber harvest activities. Furthermore, in some areas where riparian buffers have been established, partial harvest and salvage logging within them have reduced their ability to contribute large wood to streams. Also, absence of protection for riparian areas for nonfish-bearing streams has reduced the amount of wood which these streams could deliver to fish-bearing

Figure V-12. Generalized curves indicating percent of riparian ecological functions and processes occurring within varying distances from the edge of a forest stand.

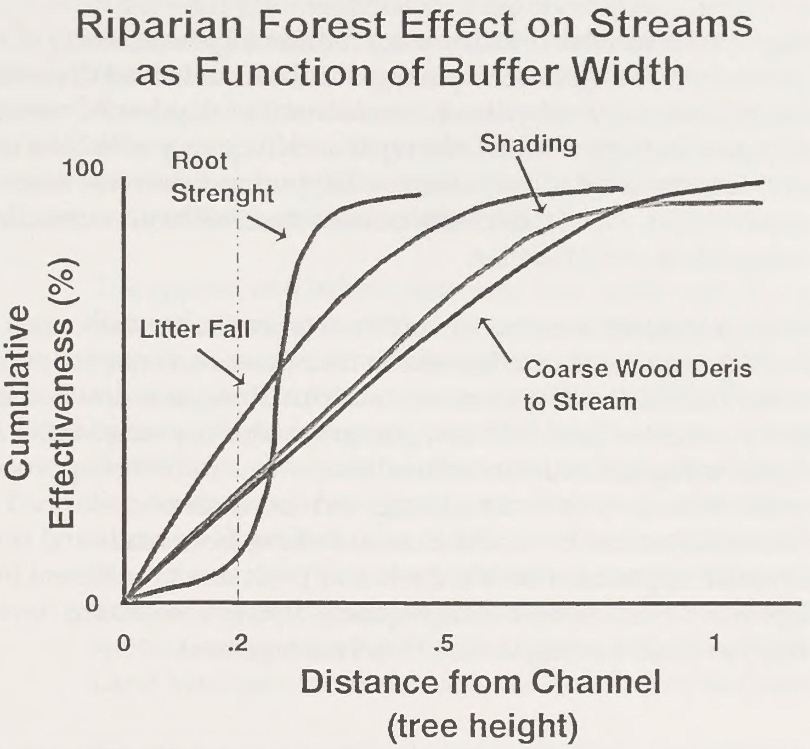
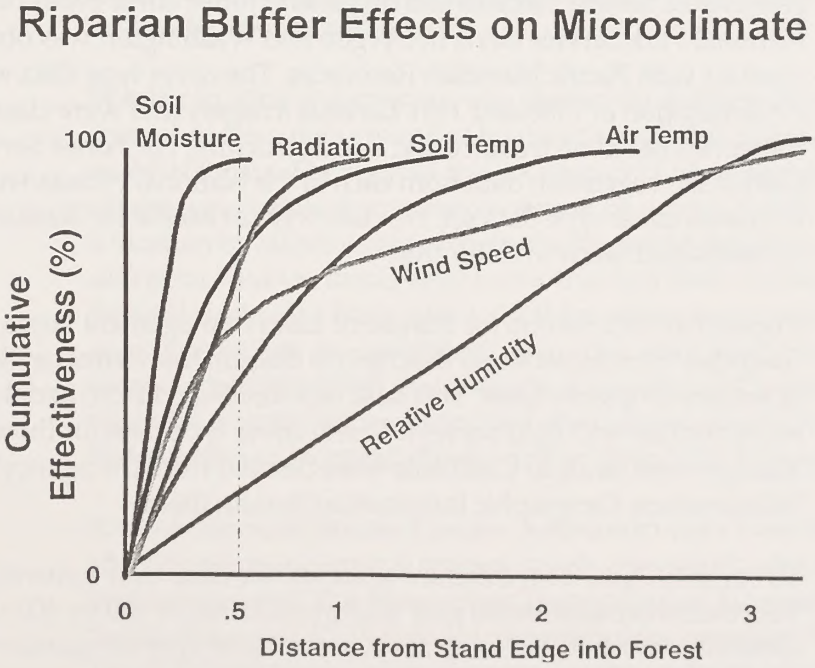


Figure V-13. Generalized curves indicating percent of microclimatic attributes occurring within varying distances of the edge of a riparian forest stand (after Chen, J 1991).



streams. Debris flows and dam-break floods resulting from natural processes or timber harvest activities may remove large wood from channels and riparian vegetation from streambanks on one portion of a drainage system and deposit this material downstream.

**AQUATIC HABITAT** A primary factor influencing the diversity of stream fish communities is habitat complexity. Attributes of habitat diversity include the variety and range of hydraulic conditions (i.e., depths and water velocities), number of pieces and size of wood, the types and frequency of habitat units, and the variety of substrates. More diverse habitats support more diverse assemblages and communities. Habitat diversity can also mediate biotic interactions such as competition and predation.

Habitat simplification may result from timber harvest activities. Timber harvest activities can result in a decrease in the number and quality of pools. Wood is a major habitat-forming element in streams. Reduction of wood in the channel, either from present or past activities, generally reduces pool quantity and quality. Constricting naturally unconfined channels with bridge approaches or streamside roads reduces stream meandering, and decreases pools formed by stream meanders and undercut banks. Increased mass failures from roads and timber harvests on unstable slopes can result in the loss of pools due to sediment influxes. Large pools, a primary characteristic of high quality aquatic ecosystems have been lost in basins that have had varying levels of land management.

## Environmental Consequences

### Terrestrial and Aquatic Assessment

### METHODS FOR ASSESSING THE EFFECTS OF ALTERNATIVES

The information for the assessment of the effects of the alternatives on terrestrial species and their habitats includes data on forest cover types and species' geographic ranges. Information on general forest cover types on Forest Service and National Park Service lands in Oregon and Washington was obtained through a contract with Pacific Meridian Resources. The cover type data were produced using a combination of 1988 and 1991 Landsat imagery and were classified into vegetation categories based on tree size and stand structure. For Forest Service lands in California, vegetation data from each of the National Forests were used to develop the forest cover type data set. No data were available for National Park Service administered lands in California.

Vegetation information for Bureau of Land Management lands in Oregon was compiled from forest stand description data on tree diameter classes of the dominant overstory trees. This data was developed from aerial photograph interpretation and field surveys. Forest cover type data for Bureau of Land Management lands in California were derived from the agency's Wildlife Habitat Relationships Geographic Information System theme.

To combine data from different agencies, the data were generalized to a geographic information system-based grid with a resolution of 400 by 400 meters square. Data were then transformed to conform to the cover type categories of the Pacific Meridian Resources classification.

The Forest Ecosystem Management Assessment Team obtained specific data sets for northern spotted owl and marbled murrelet habitat for lands administered by the Forest Service in the three states — the Bureau of Land Management in Oregon and the National Park Service in Oregon and Washington. Field offices had previously completed the classification of the spotted owl habitat for the Forest Service and Bureau of Land Management. Information on northern spotted owl habitat for National Parks in Oregon and Washington was derived from the Pacific Meridian Resources Landsat cover type data by the Forest Ecosystem Management Assessment Team. All medium and large conifer acres from the Landsat data that occurred under 4,000 feet elevation in Washington and under 5,500 feet in Oregon were tallied as spotted owl habitat.

The spotted owl habitat data were also used to identify marbled murrelet habitat on Forest Service lands within the range of the murrelet in Oregon and California; data specific to marbled murrelet habitat were not available for those lands. In Washington, marbled murrelet habitat was identified for National Forests and National Parks using updated 1989 Landsat data classified by Eby and Snyder (1990). Data for a portion of land in the Puget Sound not covered by the Eby and Snyder data were supplied by the Washington Department of Natural Resources from work by Green et al. (1993). On Bureau of Land Management lands in Oregon, the Assessment Team used field office classifications of forest stand data designating probable murrelet habitat. No data were available for either northern spotted owl or marbled murrelet habitat on lands administered by the Bureau of Land Management or the National Park Service in California.

Species range maps developed by Thomas et al. (1993) were refined for this effort by personnel from the Forest Service's Pacific Northwest Research Station in Olympia, Washington, for the mammal, bird, and amphibian species closely associated with late-successional forest. Data were based on information from field guides, scientific literature, Natural Heritage Program Database files, state agency records and review by species authorities.

Specific location information was plotted for northern spotted owls and marbled murrelets from data compiled by the state wildlife agencies of Washington, Oregon, and California. The spotted owl location data identified points on the landscape where survey data documented nesting by a pair of owls or continued occupancy of a location by either a pair of owls or a territorial single owl. Data were tallied for owl pairs, and territorial single owls that had been verified from 1987 to 1991 for all Federal lands, and from 1988 to 1992 for other ownerships where earlier surveys were incomplete or considerable new data were available. The marbled murrelet location data identified forest stands of variable size where surveys documented murrelet activity in the canopy of a given forest stand. Data coverage included all Federal lands. Occupied stands verified from 1986 through 1992 were included.

**IDENTIFICATION OF SPECIES CLOSELY ASSOCIATED WITH LATE-SUCCESSIONAL FORESTS** To identify plant and animal species closely associated with late-successional forests and components, the Assessment Team relied on (1) existing assessments and publications and (2) the advice of experts who reviewed those lists for completeness for all Federal lands within the range of the northern spotted owl.

Existing assessments and publications included the Scientific Analysis Team Report of Thomas et al. (1993), who identified old-growth forest species and evaluated their likely future under planning alternatives presented in Forest Service's Final Environmental Impact Statement on the Northern Spotted Owl (USDA Forest Service 1992). Thomas et al. (1993) identified species closely associated with old-growth forests and components of old-growth forests on National Forests within the range of the northern spotted owl. In their analysis, 667 species, fish stocks at risk, and species in parts of their range, and at-risk fish stocks, were found to be closely associated with old-growth forests.

The process used by Thomas et al. (1993) for identifying species of plants and animals closely associated with late-successional, including old-growth, forests within the range of the northern spotted owl on National Forests was adopted by the Assessment Team. Ecological information on each species was listed and used to determine (by applying specific criteria) the association of each species with late-successional and old-growth forests. (see Table IV-6) Species experts expanded this list to account for new information and for additional plants and animals found on Federal lands other than National Forests within the range of the northern spotted owl, particularly on National Parks and on Bureau of Land Management Districts. In this process, the working definition of late-successional and old-growth forests included all forests in which the dominant overstory trees were at least 80 years old. This included old-growth forests as described by Spies and Franklin (1991) and Franklin and Spies (1991), and the definition used by the Scientific Panel on Late-Successional Ecosystems (Johnson et al. 1991).

**Table IV-6** Criteria for developing the list of species closely associated with late-successional and old-growth forests. A species was included if it met at least one of the following criteria. Adapted from Thomas et al. (1993).

---

**Criterion 1:** The species is statistically significantly more abundant (based on field study or collective professional judgment of the Forest Ecosystem Management Assessment Team) in late-successional and old-growth forest than in young forest, in any part of its range.

**Criterion 2:** The species shows association with late-successional and old-growth forest (may reach highest abundance there, but not necessarily statistically so), and the species requires habitat components that are contributed by late-successional and old-growth forest (based on field study or collective professional judgment of the Forest Ecosystem Management Assessment Team).

**Criterion 3:** The species is associated with late-successional and old-growth forest (based on field study) and is on a Federal (Fish and Wildlife Service) or state threatened and endangered list, on the Fish and Wildlife Service candidate species list, Forest Service Regions 5 or 6 sensitive species list, or listed by the States of Washington, Oregon, or California as species of special concern or sensitive species.

**Criterion 4:** Field data are inadequate to measure strength of association with late-successional and old-growth forest, and the species is listed as a Federal (Fish and Wildlife Service) threatened and endangered, and the Forest Ecosystem Management Assessment Team suspects that it is associated with late-successional and old-growth forest.

OTHER SPECIES ASSOCIATED WITH LATE-SUCCESSIONAL AND OLD-GROWTH FORESTS Literally thousands of species of all taxa are integral to the late-successional and old-growth forests of the Pacific Northwest. Several previous efforts attempted to account for the effects of various forest management plans on these species. The Final Draft of the Recovery Plan for the Northern Spotted Owl (USDI 1992b) discussed 640 terrestrial species that were old-growth forest associates or threatened, endangered, or candidate species. Thomas et al. (1993) assessed the effects of various forest management options on 667 species, including 555 terrestrial species and 112 fish stocks or species.

In the FEMAT Report, the Assessment Team reviewed and updated the list of species associated with old forests. Criteria developed by Thomas et al. (1993) were used for this effort (see Table IV-6). The number of species identified is greater than shown by Thomas et al. (1993) because of new information and because the FEMAT Report focused on all federally administered lands. A total of 1,084 terrestrial species were identified as closely associated with late-successional forests on Federal lands. The number of species in each species group follows:

| | |
|---|---|
| Fungi | 524 |
| Bryophytes | 106 |
| Lichens | 142 |
| Vascular plants | 127 |
| Mollusks | 102 |
| Amphibians | 18 |
| Birds | 38 |
| Mammals | 27 |
| **Total species** | **1,084** |

In addition to this list of species, 15 functional groups of arthropods that may include as many as 10,000 individual species were reviewed. Information on these species and groups, and the effects of proposed management plans on them, is presented in Chapter 3&4 of this Draft SEIS, and in Appendix A. (Terrestrial Forest Ecosystem Assessment).

## Methods for Assessment on Maintenance of a Functional, Interconnected Late-Successional Forest Ecosystem

INTRODUCTION Assessments of likelihood of maintaining a functional, interconnected late-successional ecosystem were performed for seven of the alternatives by a panel of five experts (as described in Process for Assessing Species Viability, in this Chapter). The set of outcomes used in the ecosystem assessment panel differed from the set of outcomes defined for the species panels because an ecosystem perspective requires different evaluation criteria than a species perspective. Species assessments were based on habitats of specific organisms, while the ecosystem assessment was broader, focusing on the diversity, function, dynamics, and spatial patterns of the late-successional and old-growth forest ecosystem itself. The ecosystem assessment emphasized the primary producers of the late-successional ecosystem (i.e., the vegetation) and the processes and functions associated with the quantity, quality, and dynamics of those primary producers (i.e., the physical, chemical, and biological environment, including disturbances).

ASSESSMENT PROCESS The rating of late-successional ecosystems is based on three attributes that characterize the quantity and quality of the ecosystem. The attributes, which are described below:

1. Abundance and ecological diversity - the acreage and variety of plant communities and environments.
2. Processes and functions - the ecological actions that lead to the development and maintenance of the ecosystem and the values of the ecosystem for species and populations.
3. Connectivity - the extent to which the landscape pattern of the ecosystem provides for biological flows that sustain animal and plant populations.

**ABUNDANCE AND ECOLOGICAL DIVERSITY** Abundance of late-successional and old-growth communities and ecosystems refers to the total acreage of forest meeting structural, functional, or minimum age criteria based on sub-regional ecological conditions and definitions. These standards define forests corresponding to the maturation, transition, and shifting, small-gap stages of late-successional and old-growth forest development (see Appendix B, Section 2a, Ecological Principles for Management of Late-Successional Forests: The Basis for Standards and Guidelines for a description of these forest development stages). In the central western Cascades these conditions are typically found in stands over 80 years of age. Ecological diversity of late-successional forest ecosystems includes the occurrence of the full range of late-successional and old-growth stages (maturation, transition, and shifting, small gap and variants of these) that can develop following severe disturbance (for a full discussion see Appendix B, Section 2a, Ecological Principles for Management of Late-Successional Forests: The Basis for Standards and Guidelines). Ecological diversity also includes the distribution represented in late-successional and old-growth communities (i.e., geographic, climatic, elevation, topographic, and edaphic distributions).

A description of the four possible outcomes that were analyzed for the abundance and ecological diversity of late-successional and old-growth communities and ecosystems is shown in Table 3&4-1.

**LONG-TERM AVERAGES AND LONG-TERM AVERAGE LOWS** The long-term average regional abundance of late-successional and old-growth communities can only be approximated from a few local studies of fire history. Assuming that the average regional natural fire rotation was about 250 years for severe fires (those removing 70 percent or more of the basal area), then 60 to 70 percent of the forest area of the region was typically dominated by late-successional and old-growth forests, depending on the age at which "mature" forest conditions develop (assume a range of 80 to 100 years). Converting this range to a single number, 65 percent, provides an estimate of the long-term average percentage of the regional landscape covered by late-successional forest. This average percentage would certainly vary by physiographic province, with moist, northerly provinces having higher averages than drier provinces with higher fire frequencies.

**Table 3&4 -1.** Possible outcomes for the maintenance of abundance and ecological diversity of late-successional and old-growth ecosystems.

| | |
|---|---|
| **Outcome 1:** | Late-successional and old-growth ecosystem abundance and ecological diversity on Federal lands is at least as high as the long-term average (see below for discussion) prior to logging and extensive fire suppression.<br>Long-term is defined as a period of at least 200 to 1,000 years or the time over which the full potential range of late-successional and old-growth communities and ecosystems can develop following severe disturbance. Relatively large areas (e.g., 50,000 to 100,000 acres) would still occur in which the abundance and distribution of late-successional forests are well below the regional average for long periods. However, within each physiographic province, the abundance would be at least as high as province-level long-term averages, which might be higher or lower than the regional long-term average. |
| **Outcome 2:** | Late-successional and old-growth ecosystem abundance and ecological diversity on Federal lands is less than the long-term average conditions (prior to logging and extensive fire-suppression) but within the typical range of conditions that occurred during previous centuries.<br>Abundance and distribution would be at least as high as the long-term average of the centurial-low values (see discussion in text). Ecological diversity is characterized by presence of a wide range of late-successional stages. Distribution is characterized by presence in all physiographic provinces and elevations but with larger gaps in distribution than in outcome 1. |
| **Outcome 3:** | Late-successional and old-growth ecosystem abundance and ecological diversity on Federal lands is considerably below the typical range of conditions that have occurred during the previous centuries but some provinces are within the range of variability.<br>The ecological diversity (age-class diversity) may be limited to just the younger stages of late-successional ecosystems. Late-successional and old-growth communities and ecosystems may be absent from some physiographic provinces or elevations within physiographic provinces and/or occur as scattered remnant patches within provinces. |
| **Outcome 4:** | Late-successional and old-growth ecosystems are very low in abundance and may be restricted to a few physiographic provinces or elevational bands or localities within provinces. |

Late-successional and old-growth communities and ecosystems are absent from most physiographic provinces or occur only as small remnant forest patches.

The Assessment Team estimated that the natural fire rotation and average coverage by late-successional forest is close to values reported in the literature (Franklin and Spies 1984; USDI 1992c). The total percentage would apply to a wide range of patch sizes, from less than 1 acre to 100,000's of acres. Most of the total percentage (perhaps 80 percent or more) would probably have occurred as relatively large (greater than 1,000 acres) areas of connected forest.

The average of centurial-low (average of the lows that occur in 100-year periods) coverage by late-successional forest is defined as setting the lower bound of the "typical" range. There is no data from which to estimate the average low for the preceding 10 centuries. Consequently, this value was estimated based on the subjective opinions of the ecosystem experts. The Forest Ecosystem Management Assessment Team hypothesized that the average of low amounts might be about 40 percent coverage by late-successional forests, with lower values expected for individual provinces.

**PROCESSES AND FUNCTION** Processes refer to ecological changes or actions that lead to the development and maintenance of late-successional and old-growth ecosystems at all spatial and temporal scales. Examples include: (1) tree establishment, maturation, and death, (2) gap formation and filling, (3) understory development, (4) small and large-scale disturbances such as fire and wind, (5) decomposition, (6) nitrogen fixation, (7) canopy interception of energy and matter, and (8) energy and matter transfers between the forest and atmosphere.

Functions, in this case, refer to ecological values of the late-successional ecosystem or its components that (1) are of value to maintenance of populations of species that use these ecosystems and (2) contribute to the diversity and productivity of other ecosystems (e.g., the carryover of large dead trees to early successional ecosystems, and storage of carbon in the global ecosystem). Examples of ecosystem functions include habitat for organisms, climatic buffering, soil development and maintenance of soil productivity through inputs of large woody debris, nitrogen fixation, spread of biotic and abiotic disturbance through landscapes, and source-sink in landscapes for organisms and structures.

A description of the four possible outcomes that were analyzed for the maintenance of ecological processes and function of late-successional and old-growth communities and ecosystems is shown in Table 3&4 -3.

**CONNECTIVITY** Connectivity is a measure of the extent to which the landscape pattern of the late-successional and old-growth ecosystem provides for biological and ecological flows that sustain late-successional and old-growth associated animal and plant species across the region. Connectivity does not necessarily mean that the late-successional and old-growth areas have to be physically joined in space, as many late-successional species can move (or be carried) across areas that are not in late-successional ecosystems conditions. Landscape features affecting connectivity of late-successional ecosystems are (1) distance between late-successional and old-growth areas and (2) forest conditions in areas between late-successional and old growth areas. The four possible outcomes for the maintenance of ecological connectivity in late-successional and old-growth ecosystems that were analyzed by the Assessment Team is described in Table 3&4 -4.

**Table 3&4 -2.** Possible outcomes for the maintenance of ecological processes and function of late-successional and old-growth ecosystems.

| | |
|---|---|
| **Outcome 1**: | Full range of natural disturbance and vegetative development processes and ecological functions are present at all spatial scales, from microsite to large landscapes. |
| **Outcome 2**: | Natural disturbance and vegetative development processes and ecological functions occur across a moderately wide range of scales but are limited at large landscape scales through fire suppression and limitation of areas where late-successional ecosystems can develop. |
| **Outcome 3**: | Natural disturbance and vegetative development processes are limited in occurrence to stand and microsite scales. Many stands may be too small or not well-developed enough to sustain the full range of ecological processes and functions associated with late-successional and old-growth ecosystems. |
| **Outcome 4**: | Natural disturbance and vegetative development processes associated with late-successional and old-growth ecosystems are extremely restricted or absent from most stands and landscapes. Most late-successional and old-growth stands are too small or not well-developed enough to sustain the full range of processes and ecological functions associated with late-successional and old-growth ecosystems. |

Overall outcome descriptions were obtained by combining the individual attribute outcomes into four overall outcomes for the ecosystem as a whole. The likelihoods of achieving overall outcomes were computed by averaging the likelihoods of individual attribute outcomes.

An assessment was not conducted on individual elements of aquatic and riparian habitat. The Aquatic Conservation Strategy (Appendix B)was designed to incorporate all elements of the aquatic and riparian ecosystem, including maintenance of hydrologic function, high water quality, adequate amounts of large woody material, a stable, complex stream channel, and a riparian area with suitable microclimate and vegetation.

Assessments were conducted on species or groups of species of plants and animals using aquatic and riparian habitat. The discussions of the outcome of the assessments includes comments on the ability of the Aquatic Conservation Strategy to provide all necessary habitat needs. The assessments assumed adoption of the full Aquatic Conservation Strategy, including Watershed Analysis and a comprehensive program of watershed restoration.

Particular attention was given to the width of the Riparian Reserves. The assessments used three Scenarios based on the protection given to intermittent streams. Scenario 1 used a Riparian Reserve width of one mature tree height,

**Table 3&4 -3.** Possible outcomes for the maintenance of connectivity of late-successional and old-growth ecosystems.

| | |
|---|---|
| **Outcome 1:** | Connectivity is very strong, characterized by relatively short distances (less than 6 miles on average) between late-successional and old-growth areas. Smaller patches of late-successional and old-growth frequently occur. "Small patches" consist of riparian buffers, green tree retention patches, individual live and dead old-growth trees. The proportion of the landscape covered by late-successional and old-growth conditions of all patch sizes exceeds 0.6, a threshold when many measures of connectivity increase rapidly. At regional scales, physiographic provinces are connected by presence of landscapes containing areas of late-successional and old growth forests. |
| **Outcome 2:** | Connectivity is strong, characterized by moderate distances (less than 12 miles on average) between large late-successional and old growth areas. Smaller patches of late-successional forest occur as described in outcome 1. At regional scales, physiographic provinces are connected by presence of landscapes containing areas of late-successional and old-growth forest. Total proportion of landscape in late-successional and old-growth conditions, including smaller patches, is at least 0.5, so that the late-successional condition is still the dominant cover type. |
| **Outcome 3:** | Connectivity is moderate, characterized by distances of 12-24 miles between large old-growth areas and limited occurrence of smaller patches of late-successional forest in the matrix. The late-successional forest is at least 25 percent of the landscape, and the matrix contains some smaller areas for dispersal habitat. |
| **Outcome 4:** | Connectivity is weak, characterized by wide distances (greater than 24 miles) between old-growth areas and a matrix in which late-successional and old-growth conditions occur as scattered remnants or are completely absent. |

Scenario 2 used a Riparian Reserve width of one-half mature tree height outside Key Watersheds, and Scenario 3 used a Riparain Reserve width of one-sixth mature tree height on all streams and reduced protection for perennial, non-fish bearing streams.

While no assessments were made of habitat elements, components of the Aquatic Conservation Strategy, particularly Riparian Reserves and Key Watersheds, were briefly evaluated on their capability to provide aquatic and riparian habitat elements as part of the evaluation of results from all the assessment panels.

### Process for Assessing Habitat Sufficiency

For the 10 alternatives the Assessment Team evaluated the likelihood of maintaining sufficient habitat, well distributed on Federal lands to provide for the continued existence of viable populations of northern spotted owls and marbled murrelets. For seven of the 10 alternatives, similar assessments were performed for over 1,000 plant and animal species closely associated with old-growth forests. The geographic bounds were the range of the northern spotted owl; the time frame was 100 years.

The Assessment Team convened assessment panels to elicit high quality judgments about future outcomes of the alternatives from knowledgeable experts. Panelists were selected using several criteria including technical expertise with the taxa, ecological understanding of habitat requirements, availability to attend panel sessions, and representation of a diversity of technical expertise. Nearly 70 panelists came from the private sector and public sector, universities, and state and Federal agency research branches. The Assessment Team used advice from the panels, other information and their own expertise to make its final assessments.

There were 14 separate panel assessments conducted, during late April and again in June 1993 covering all major plant and animal taxa associated with late-successional and old-growth forest ecosystems in the Pacific Northwest within the range of the northern spotted owl. The Assessment Team viewed the evaluations "not as precise analyses of likelihood of habitat and population conditions, but rather as judgements of knowledgeable experts" (Appendix A, Option Development and Description).

"The rating process was a subjective evaluation of the sufficiency of the amount and distribution of late-successional and old-growth habitat on Federal lands under each option to support the species or group of species over the next 100 years. For most species, the information necessary to precisely quantify the response to changes in the quality and pattern of their environments simply does not exist. Our evaluations, therefore, should not be viewed as precise analyses of likelihoods of persistence or extinction; they represent the Forest Ecosystem Management Assessment Team's judgment as to the sufficiency of habitat on Federal lands to support viable populations of the species examined. With additional data and studies, the ability to predict response of species to habitat change will improve" (Appendix A, Overview and Summary).

The panelists' assessment was expressed as a likelihood, on an outcome based scale, regarding the sufficiency of habitat of Federal lands to provide for species persistence under the alternatives. This scale represents the range of possible trends and future condition of habitat for future habitat on Federal lands. Each of four "outcomes" describes a biological condition that is observable and mutually exclusive of the other three outcomes. Outcome A describes a level of habitat that is of sufficient quality, distribution, and abundance to allow the species population to stabilize, well-distributed across Federal lands. Outcome B describes a level of habitat that is of sufficient quality, distribution, and abundance to allow the species population to stabilize, but with significant gaps in the historic species distribution across Federal lands. Outcome C describes a level of habitat which only allows continued species existence in refugia, with strong limitations on interactions among local populations on Federal lands. Outcome D describes a level of habitat conditions which would result in species extirpation from Federal land (Table IV-7, Appendix A).

The actual ratings of likelihoods was individual, followed by group display and discussion. Verification was also handled in the discussion step, as panelists explained reasons for their ratings. Group interaction was used to clarify knowledge and exchange individual reasoning. The final assessment was individual and there was no attempt to achieve consensus.

Panelists were asked to assign 100 "likelihood votes" over the four outcomes in the scale for each alternative and species The panelist could express complete certainty in a single outcome by allocating 100 points. The panelist could express complete uncertainty by spreading 25 votes across the outcomes. Panelists, or the group, could refrain from assessing a species if there was simply too little understanding to make an informed opinion.

Ratings were averaged across panelists for each outcome under each alternative for each species. The panel leader in conjunction with other team members evaluated the results to correct any obvious errors or apparent misunderstandings that might have led to illogical results.

The Assessment Team "compared outcomes of options by assessing whether a species (or group) attained an 80 percent or greater likelihood of achieving outcome A: Habitat is of sufficient quality, distribution, and abundance to allow the species population to stabilize, well distributed across Federal lands (see Table IV-7 additional description). This basis of comparison represents a relatively secure level of habitat and thus provides a stringent criterion for comparison. The same process was used to assess the likelihood of maintaining a functional, interacting late-successional and old-growth ecosystem.

"In focusing on the attainment of 80 percent likelihood of achieving outcome A, we are not suggesting that only options attaining that likelihood satisfy the viability regulation. We think it likely that options attaining such a percentage would be viewed as meeting the requirement, but a score of less than 80 should not automatically be regarded as a failing grade. Similarly, in some instances it may be appropriate to look at categories A and B (that is, A plus B) as the benchmark. Indeed, in situations where a species is already restricted to refugia, it may be appropriate to look at A plus B plus C" (Appendix A, Overview and Summary).

**Role of Nonfederal Lands** The majority of species inhabiting late-successional forests in the Pacific Northwest are not restricted to habitat on Federal lands. Nonfederal lands are an integral part of any strategy that seeks to address the overall landscape as an ecosystem. Therefore, this interrelationship will require close cooperation between state agencies, tribes, private landowners, and Federal agencies. This is particularly important for threatened and endangered species or other at risk species.

There are opportunities for mutually desirable goals to be met on Federal and nonfederal lands in species conservation. These opportunities depend on the species, its present biological condition, location within the range of the northern spotted owl, and the extent of the state and private partnership opportunity. However, the lead agencies here (Forest Service and BLM) have no authority to regulate activities or their timing on lands other than those they administer. Timber harvest on nonfederal lands is controlled by state timber practices, acts, and by a number of state and Federal regulations, to protect the productivity and environmental quality of the land, air and water.

The Assessment Team noted that some species are influenced so strongly by habitat on nonfederal lands or other conditions that their continued persistence is in question regardless of Federal land management. In many of the above situations the fate of the species is not principally a function of the management of Federal forest lands and must be addressed via other venues.

## EFFECTS OF ALTERNATIVES ON TERRESTRIAL ECOSYSTEMS

### Amounts of Late-Successional and Old-Growth Forests in Designated Areas

The Alternatives are estimated to allocate between 5.9 and 8.5 million acres of late-successional forests in several land allocation categories: Congressionally Withdrawn, Administratively Withdrawn, Late-Successional Reserves, and Riparian Reserves (Tables 3&4 -4, IV-10, Appendix A). This represents 69 to 100 percent of the current late-successional and old-growth forests on Federal lands. The degree of protection varies by state and physiographic province and elevation; the highest percentages are protected in the state of Washington and the lowest percentages are protected in Oregon.

From 42 to 53 percent of the Late-Successional Reserves are currently covered by late-successional forests depending on the alternative (Table 3&4 -4). This illustrates that the Late-Successional Reserves were designated around large areas containing a mixture of age classes. Alternative 1 has a higher percentage of late-successional forest in Late-Successional Reserves than the other alternatives because many of its reserves were created by delineating boundaries around small concentrations of late-successional forest (LS/OG3s of Johnson et al. 1991). The remaining area of the reserves is covered by smaller, naturally regenerated conifers, conifer plantations, deciduous forests, younger successional stages following logging and natural disturbances, and nonforested areas. The Late-Successional Reserves have a higher percentage of late-successional forest in them than federal managed lands as a whole (Table 3&4 -4) and the matrix lands.

### Projections of Forest Development in Late-Successional and Old-Growth Forests Over Time

Forests of the Pacific Northwest within the range of the northern spotted owl are dynamic. The Forest Ecosystems Management Assessment Team attempted to demonstrate the development of younger, even-aged forest into late-successional forest stands over the next 150 years. The proportion of late-successional forest in designated areas is expected to increase over time under all alternatives. The reserves currently contain 47 to 58 percent (depending on the alternative) of younger natural forests and plantation forests. Over time most of these areas will probably develop late-successional characteristics through stand development processes. The future amount of late-successional and old-growth forest will depend on the frequency of large, severe disturbances and the occurrence of "typical" stand developmental processes. The Assessment Team was unable to model future amounts of late-successional forests in designated areas except under a simple set of assumptions as described below.

A simulation of forest development in the reserves was conducted starting with current conditions estimated from satellite imagery classified for the Forest Service by Pacific Meridian Resources. The simulation was applied to the following land allocations in western Oregon and Washington: Congressionally Withdrawn, Administratively Withdrawn, and Late-Successional Reserves. The simulation was based on simple assumptions about growth of trees from one forest cover size class into another and did not include disturbance. It also did not take into account that

**Table 3 &4 -4**. (Adapted from Table IV-9, Appendix A) Acreages and percentages of forests dominated by medium and large conifers by Federal land allocations. ("Total Reserve" includes 2,450,800 acres in Congressionally Withdrawn Areas)

| Alternative | Total Federal lands | Late-Successional Reserve | Administrative Withdrawn | Riparian Reserve | Total Reserve[1] | Adaptive Management/ Managed Late-Successional[2] | Matrix |
|---|---|---|---|---|---|---|---|
| 1 | 8,530,900 | 6,060,800 | 0 | 7,100 | 8,518,800 | 0 | 12,100 |
|  | (35%) | (53%) | - | (.4%) | (40%) | - | (.4%) |
| 2 | 8,530,900 | 3,777,800 | 431,500 | 561,100 | 7,221,200 | 0 | 1,309,100 |
|  | (35%) | (42%) | (28%) | (28%) | (37%) | - | (27%) |
| 3 | 8,530,900 | 3,336,000 | 518,100 | 609,000 | 7,310,100 | 396,100 | 1,220,800 |
|  | (35%) | (42%) | (31%) | (29%) | (37%) | (47%) | (27%) |
| 4 | 8,530,900 | 3,553,700[3] | 453,800 | 851,700 | 7,310,000 | 0[3] | 1,220,500 |
|  | (35%) | (42%) | (27%) | (30%) | (37%) | - | (28%) |
| 5 | 8,530,900 | 2,930,200[3] | 610,700 | 838,400 | 6,830,100 | 0[3] | 1,700,400 |
|  | (35%) | (43%) | (29%) | (32%) | (37%) | - | (30%) |
| 6 | 8,530,900 | 3,220,500 | 550,900 | 682,700 | 6,904,900 | 0 | 1,626,300 |
|  | (35%) | (43%) | (30%) | (30%) | (37%) | - | (29%) |
| 7 | 8,530,900 | 2,579,000[3] | 691,700 | 194,000 | 5,915,500 | 0[3] | 2,615,100 |
|  | (35%) | (44%) | (30%) | (31%) | (37%) | - | (31%) |
| 8 | 8,530,900 | 3,220,500 | 550,900 | 451,100 | 6,673,200 | 0 | 1,857,700 |
|  | (35%) | (43%) | (30%) | (30%) | (37%) | - | (29%) |
| 9 | 8,530,900 | 2,975,100 | 500,700 | 696,600 | 6,623,200 | 457,000 | 1,450,700 |
|  | (35%) | (42%) | (30%) | (31%) | (36%) | (31%) | (30%) |
| 10 | 8,530,900 | 3,220,500 | 550,900 | 682,700 | 6,904,900 | 0 | 1,626,300 |
|  | (35%) | (43%) | (30%) | (30%) | (37%) | - | (29%) |

[1] Total Reserve includes Administrative Withdrawn.

[2] The acres reported for Alternative 3 represent Managed Late-Successional Areas, while the acres reported for Alternative 9 represent Adaptive Management Areas.

[3] Small amounts of Managed Late-Successional Areas (less than 75,000 acres) are included in the Late-Successional Reserve acreages for Alternatives 4, 5, and 7.

many dense young plantations within the reserves would probably take longer to develop late-successional conditions, or perhaps not ever develop them. A disturbance correction was later applied to the growth output by assuming that 12.5 percent of the reserves would be subject to severe disturbance over 50 years. This translates to a 400-year natural disturbance rotation. The simulation assumed that partial fire suppression would occur, thus driving the natural disturbance rotation longer than the presettlement regional average of about 250 years. Under these assumptions, about 80 percent of the reserves on average would eventually be covered by forests older than 80 years (Figure IV-2).

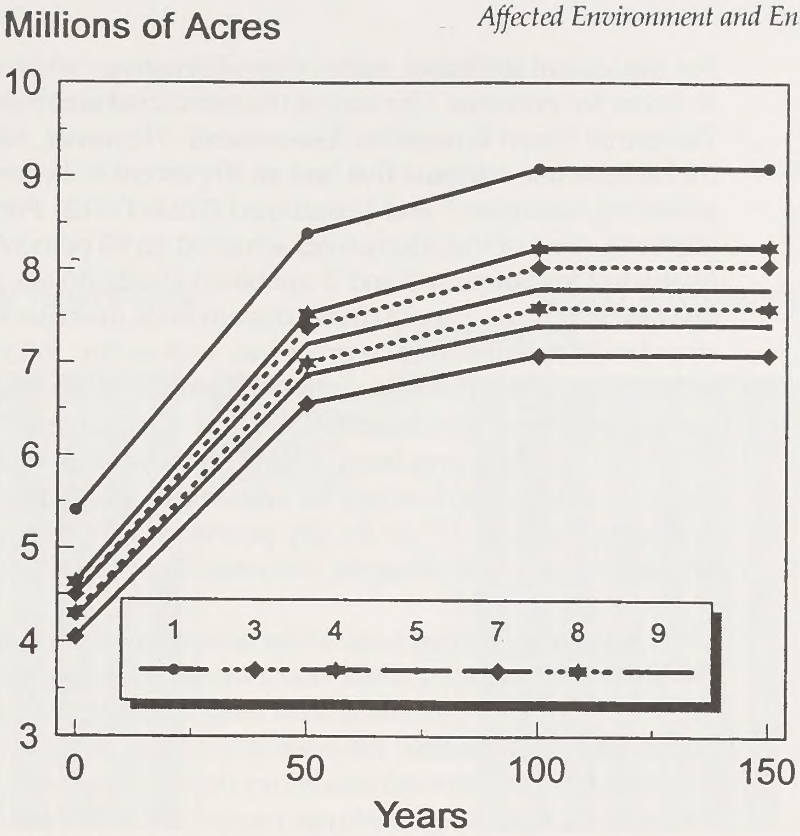


**Figure IV-2.** Projected acreage of late-successional forest (stands with dominant trees at least 21 inches in diameter) on Congressionally and Administratively Withdrawn Areas and in Late-successional Reserves in Oregon and Washington over the next 150 years.

## Results of Assessment on Maintaining a Functional, Interconnected Late-Successional Forest Ecosystem

The effects of the alternatives on the late successional ecosystem were evaluated in terms of degrees (outcomes 1-4) of ecosystem quantity and quality (abundance, diversity, processes, functions and connectivity). The outcomes were characterized, in part, by how they compare to hypothesized long-term averages and typical ranges. See Methods for Assessment of the Maintenance of a Functional, Interconnected Late-Successional Ecosystem earlier in this chapter for further information. Long-term past conditions (the last 1000 years) are not necessarily the best standard by which to evaluate the future late-successional ecosystem. However, past conditions provide a reference point for current and future conditions and an opportunity for understanding processes that lead to the development and maintenance of the current late-successional ecosystem.

During the next 100 years, none of the alternatives provides for a higher than 60 percent likelihood of reaching an outcome in which the quality and quantity (as defined by the three attributes) of the overall late-successional ecosystem would be at least as high as the hypothesized long-term average condition (Outcome 1). The Assessment Team concluded that a longer timeframe may be necessary for this change to occur. However, two of the alternatives (3 and 4 in moist provinces) attained at least an 80 percent cumulative likelihood of reaching an outcome in which the quantity and quality of the overall late-successional ecosystem would fall within the hypothesized, typical long-term range of conditions (Outcomes 1 and 2) (Figure IV-3, Table IV-13). The other alternatives had a 62 to 77 percent likelihood of reaching outcomes 1 and 2 combined in moist provinces. No alternatives achieved an 80 percent or higher cumulative likelihood of reaching outcome 2 or better in the dry provinces (Figure IV-3, Table IV-13).

For individual attributes, none of the alternatives achieved a likelihood of 80 percent or better for outcome 1 for any of the individual attributes (see Appendix A, Terrestrial Forest Ecosystem Assessment). However, Alternatives 1, 3, 4, 5, and 9 had at least one attribute that had an 80 percent or better cumulative likelihood of achieving outcomes 1 and 2 combined (Table IV-13). For the "process and function" attribute, none of the alternatives achieved an 80 percent or better cumulative likelihood for outcome 1 and 2 combined (Table IV-13). This occurred primarily because outcomes 1 and 2 under this attribute describe a condition in which larger scale landscape disturbance processes, such as fire, follow long-term natural behavior, which is unlikely. In the dry provinces, no alternative achieved an 80 percent or greater likelihood for outcome 1 and 2 combined for any attribute (Table IV-13). In the moist provinces, Alternatives 3, 4, and 9 achieved a 62 to 93 percent cumulative likelihood ratings for outcomes 1 and 2 combined under all three attributes (Table IV-13). In the dry provinces, no alternatives achieved a 60 percent or greater likelihood rating for outcomes 1 and 2 under all attributes (Table IV-13).

The results indicate that none of the alternatives had a 60 percent or greater likelihood of producing a late-successional and old-growth ecosystem with attributes that approximate at least long-term average conditions (outcome 1). This occurs primarily because 100 years is not long enough for the cutover landscapes to return to late-successional conditions that approximate prelogging conditions. Many late-successional attributes require 200 to 500 years to develop. In addition, many larger scale disturbance processes such as severe wildfire will probably not occur under any of the alternatives, at least not to the extent that they would in an environment that was not influenced by humans.

Some alternatives do have an 80 percent or greater cumulative likelihood of achieving an overall ecosystem condition at 100 years that is hypothesized to fall within the typical range of conditions that have occurred over previous centuries (outcomes 1 and 2 combined) . This does not mean, however, that all attributes and stands would meet this condition. Many young forest plantations within reserves are not developing along typical pathways, and fire suppression has and will alter the stand and landscape-level processes that are typical in these ecosystems. In general, high rates of logging, forest plantations, fire suppression, ownership patterns, and human population and environmental influences have altered the regional ecosystem on Federal lands to the extent that none of the alternatives can provide for a return to conditions that closely match those of previous centuries. It is not expected that all ecosystem processes, such as wildfire, will be allowed to perform their natural functions across the landscape. Site conditions across all landscapes will not return to their pre-settlement conditions within the next 100 years. However, all of the alternatives reverse the trend of the last 50 years on Federal lands, which, if continued, would have resulted in a steep decline in the quantity and quality of the late-successional ecosystem and its eventual loss in many Federal planning areas.

Some of the alternatives provide greater likelihoods than others of maintaining and enhancing the late-successional ecosystem at levels that approach typical long-term conditions. Alternatives 1, 3, 4, and 9 received the highest ratings (Figure IV-3). Alternatives 3 and 4 provide for relatively high amounts of late-successional forest and strong connectivity through presence of riparian reserves and retention of old-

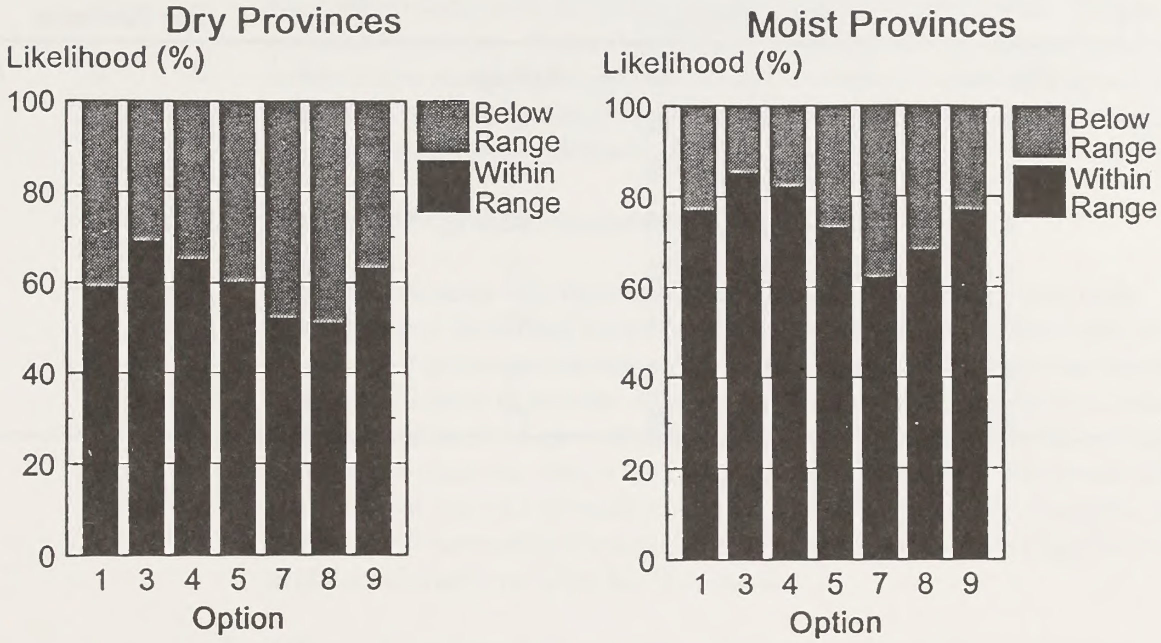


**Figure IV-3.** Likelihood of achieving outcomes in which most attributes of the late successional ecosystem fall within the typical range of variability (Outcomes 1 and 2) and in which most attributes of the late successional ecosystem fall below the typical range of variability (Outcomes 3 and 4) by dry and moist provinces.

**Table IV-13.** Likelihood of achieving outcomes 1 and 2 combined for different ecosystem attributes and average of attributes. Numbers in bold are at least 80 percent likelihood. Attributes: A = Abundance and Diversity; P = Process and Function; C = Connectivity.

| | Moist Provinces | | | | Dry Provinces | | | |
|---|---|---|---|---|---|---|---|---|
| Option | A | P | C | Average | A | P | C | Average |
| 1 | **86** | 52 | **92** | 77 | 66 | 34 | 76 | 59 |
| 3 | **92** | 71 | **90** | **85** | 75 | 53 | 78 | 69 |
| 4 | **93** | 62 | **90** | **82** | 75 | 46 | 76 | 65 |
| 5 | **80** | 59 | **80** | 73 | 69 | 47 | 66 | 60 |
| 7 | 66 | 50 | 68 | 62 | 64 | 41 | 51 | 52 |
| 8 | 69 | 59 | 74 | 68 | 64 | 38 | 53 | 51 |
| 9 | 76 | 75 | **80** | 77 | 69 | 53 | 66 | 63 |

growth components in managed matrix. Alternatives 3 and 4 also provide relatively high acreage of low elevation (0 to 4000 feet) (see Appendix A, Terrestrial Forest Ecosystem Assessment) late-successional ecosystems, which are relatively rare throughout the region. Although Alternative 1 provides for the highest acreage of Late-Successional Reserves, it did not achieve an 80 percent or greater likelihood because it lacks restoration by silvicultural treatments in the reserves. The Assessment Team assumed that without restoration silviculture, late-successional conditions would be retarded in development. Alternative 9 achieved a 60 to 80 percent or greater likelihood rating for the overall ecosystem for outcomes 1 and 2 combined in moist provinces (Table IV-13). Alternative 9 might have achieved a higher overall ranking if it provided for more acreage of late-successional ecosystems in the low elevations in Oregon. The Assessment Team felt that the opportunities to increase knowledge about ecosystem function and management in the Adaptive Management Areas of Alternative 9 actually increased the likelihood that this option would provide late-successional characteristics in the future.

Other reasons for not achieving 80 percent or greater likelihoods for outcome 1 alone or outcomes 1 and 2 combined include:

1. **Inherent dynamics of the ecosystems and environment**. The probabilities of large-scale disturbances and other environmental changes during the next 100 years are high. The region has historically been subjected to large fires and, in coastal areas, to wind disturbances that could substantially reduce the area and character of late-successional and old-growth forest ecosystems in Late-Successional Reserves. Although fire suppression will be practiced, it may not

be sufficient to prevent loss of large portions of late-successional and old-growth forests. The risk of large-scale change in Late-Successional Reserves is particularly high in the eastern Cascade provinces and drier portions of the Oregon and California Klamath provinces. The higher risk of large-scale change in these provinces is the primary reason that none of the alternatives achieved an 80 percent or greater cumulative likelihood of outcome 1 and 2 combined in the eastern Cascades and Klamath area (Table IV-13). Climate change is projected by many climatologists to occur under increasing carbon dioxide levels in the atmosphere during the next century. Climate change and disturbances such as fire and wind could have widespread direct and indirect effects on ecosystem processes, functions, and stability (Franklin et al. 1991).

### Possible Mitigation Measures

**Eastern Cascades and Klamath Provinces:** Use active fire and fuels management, including thinning and prescribed fire, to reduce risk of large-scale loss of late-successional and old-growth forests and restore fire-dependent types of old-growth species. Manage the entire public landbase to achieve late-successional and old-growth objectives at a landscape scale rather than just designated reserves. Allow for more dynamic and less stable levels of late-successional and old-growth habitat to reflect the dynamic character of the landscape. These mitigation measures could increase the ratings for outcomes 1 and 2 combined to at least 60-79 percent.

2. **Effects of land use history and ownership patterns.** Past management practices, current ownership patterns and land use objectives contribute to the relatively low likelihood for outcome 1. Given the nature of the disturbance regime and the possibility of climate change, none of the alternatives provides broad latitude for large-scale change and uncertainties of knowledge. Public lands alone may be adequate in area to maintain late-successional ecosystems in the face of large-scale change. From a regional perspective the current area and diversity of late-successional and old-growth forest ecosystems has been reduced to less than 20 percent of the landscape (public and private land). Some late-successional and old-growth forest types, such as fire-dependent ponderosa pine, have been reduced to a small fraction of historical levels. Some community and ecosystem types in low elevations and valley margins have been totally lost. Stand level practices that have created dense young plantations within reserves in all of the alternatives have altered the typical pathways by which stands develop into old growth. Artificially created, overly dense, young plantations may not develop late-successional conditions, such as multiple canopy layers, for long periods. In addition, plantations may be more susceptible to insect, disease, and fire disturbances that could threaten existing late-successional forests within reserves. Without silvicultural practices to "correct" or "restore" stand development conditions in plantations, the current and future late-successional ecosystem is at a relatively high risk of loss or inadequate development. This is the primary reason that Alternative 1, which reserves the largest area for late-successional forest, did not achieve an 80 percent or greater cumulative likelihood rating in the overall ecosystem for outcomes 1 and 2 combined (Table IV-13). The Assessment Team indicated that the absence of restoration silviculture in plantations in reserves under this option reduced the likelihood of achieving outcomes 1 and 2 combined to below 80 percent.

**Possible Mitigation Measures**

**Moist Provinces:** Suggest potential management for late-successional and old-growth ecosystems or components of late-successional and old-growth ecosystems on state and private lands in provinces where Federal lands occupy a small percentage of the land base, such as the California and Oregon Coast Range Provinces and areas where private and Federal lands are interspersed in a checkerboard pattern of alternating sections. State lands in the southwest Washington and the northern Oregon Coast Range offer significant opportunities to fill gaps in the regional late-successional ecosystem. Careful application of restoration silviculture in young plantations to promote development of late-successional and old-growth forests would probably improve the rating of Alternative 1 to at least an 80 percent cumulative likelihood of reaching outcomes 1 and 2 combined.

**Eastern Cascades and Klamath provinces:** Past history of fire exclusion has altered ecosystem structure and function and resulted in a loss of fire-dependent ecosystem communities, such as Ponderosa pine. Reintroducing fire or a suitable substitute, such as thinning and reducing fuels, could mitigate this loss.

3. *Lack of scientific information*. The relatively low likelihood ratings for outcomes 1 and 2 combined for most alternatives reflect, in part, lack of information about: processes and functions of late-successional and old-growth ecosystems; the nature, role, and importance of landscape-level ecological processes including disturbance; the role and relationship of species diversity and ecosystem functions such as productivity, nutrient cycling, and decomposition; and the effects of climate change. There was disagreement among panel members about particular outcomes. This reduced likelihood scores for all outcomes under all alternatives.

   **Possible Mitigation Measures**

   **All provinces:** Continue to increase basic studies of ecosystem structure, function, and dynamics at multiple spatial and temporal scales. Conduct monitoring and long-term studies of processes associated with late-successional and old-growth and related ecosystems. Such studies might increase or decrease ecosystem ratings and suggest changes to standards and guidelines that would increase the possibility of meeting ecological and resource objectives.

4. *Additional mitigation measures on Federal lands.* Modifications to standards and guidelines are possible. See Appendix B, Section 2a, Ecological Principles for Management of Late- Successional Forests, The Basis for Standards and Guidelines, for a thorough discussion of possible measures that can be considered to assist in the maintenance of functional, interconnected late-successional ecosystems.

**Possible Mitigation Measures** Some green trees that are retained in harvest units in the matrix could be left in patches rather than as dispersed individuals. Diversity of tree structure could be considered when leave trees are selected. Large snags and green trees need to be well-distributed throughout the matrix.

Mitigation measures that would benefit arthropods, fungi, and plants include providing a full spectrum of species and sizes of trees for retention as large woody debris in the matrix. While this would promote species diversity among all of these organisms, it is especially important for those that are host or substrate specific.

Past land use and forestry practices have altered the condition of stands and landscapes within the proposed reserves. As much as 40 percent of the Late-Successional Reserves currently in young plantations were established for timber production. The plantations are typically densely stocked with young Douglas-fir trees and are unlikely to follow "natural" stand development pathways toward late-successional conditions. Consequently, late-successional forest development in these plantations may be retarded or not occur at all. In addition, it is recognized that young plantations can facilitate the occurrence and spread of fire and other disturbances through landscapes. The presence of young plantations in Late-Successional Reserves, thus, may increase the risk of loss of intermingled late-successional forests. This is especially true in the high elevations of the Cascade Range and dry parts of the Klamath/Siskiyou Physiographic Provinces, where fire suppression has led to the development of dense understories of shade-tolerant species that increase the potential for severe fire impact in the reserves.

Roads, which are an additional alteration of the areas relative to more natural conditions, may alter hydrological disturbances, facilitate the spread of nonnative organisms, and increase the level of human activities on the landscape, including the incidence of fire.

Given the past land use activities in the reserves and the potential impact of them on natural processes, restoration activities may be needed to maintain and enhance late-successional ecosystem processes. Restoration could include activities such as thinning, patch cutting, and underplanting of conifers to reduce the density of young stands, increase their structural and compositional heterogeneity, and reduce the risk of severe fire. In addition, roads could be removed or blocked to reduce the negative impacts of their use on the ecosystem.

### EFFECTS OF ALTERNATIVES ON AQUATIC ECOSYSTEMS

Each of the alternatives developed for managing federal lands within the range of the northern spotted owl include a set of Late-Successional Reserves. Total area in Late-Successional Reserves varied from 5.8 to 11.5 million acres (Table II-3, Appendix A) depending on the option. While these reserves were not derived from the Aquatic Conservation Strategy, they are an important component. They confer two major benefits to fish habitat and aquatic ecosystems. First, the Standards and Guidelines under which the Reserves are managed limit activity in these areas, providing increased protection for all stream types. Second, since these Reserves possess late-successional characteristics, they tend to be relatively undisturbed areas although some management may have taken place in them in the past. Some Reserves offer core areas of good stream habitat in predominantly degraded landscapes that will act as refugia and centers from which degraded areas can be recolonized as they recover. Streams in these Reserves may be particularly important for endemic or locally distributed fish species and stocks.

The likelihood of achieving an outcome where there is sufficient quality, distribution and abundance of habitat to allow plant and animal species to stabilize, well distributed across federal lands, is lower for Alternatives 2, 3, 5, 6, 9, and 10 than for Alternatives 1 and 4. However, Assessment Team concluded that all alternatives except 7 and 8 will reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on federal lands within the range of the northern spotted owl. Even if changes in land management practices and comprehensive restoration are initiated, it is possible that no alternative will completely recover all degraded aquatic systems within the next 100 years. The likelihood of attaining a functioning late-successional/old growth ecosystem in the next 100 years is reduced because some characteristics of these terrestrial ecosystems will not be obtained for at least 200 years. Similarly, the Assessment Team expects that degraded aquatic ecosystems will not be fully functional in 100 years. Faster recovery rates are probable for aquatic ecosystems under Alternatives 1 and 4 than other alternatives (Figure V-26). Alternative 1 and 4 would reduce disturbance across the landscape due to application of a larger Late-Successional Reserve network and use of Riparian Reserve 1 scenario, that requires wider interim Riparian Reserves for intermittent streams in non-Key watersheds than in other scenarios.

## Riparian

Every watershed in National Forests and Bureau of Land Management Districts within the range of the northern spotted owl will have Riparian Reserves. Land allocated to Riparian Reserves status varies between alternatives from 0.62 to 2.88 million acres (Table IV-10, Appendix A).

All alternatives except 7 and 8 include either Riparian Reserve scenarios 1 or 2. Both Riparian Reserve 1 and 2 institute an anti-degradation policy for aquatic systems on

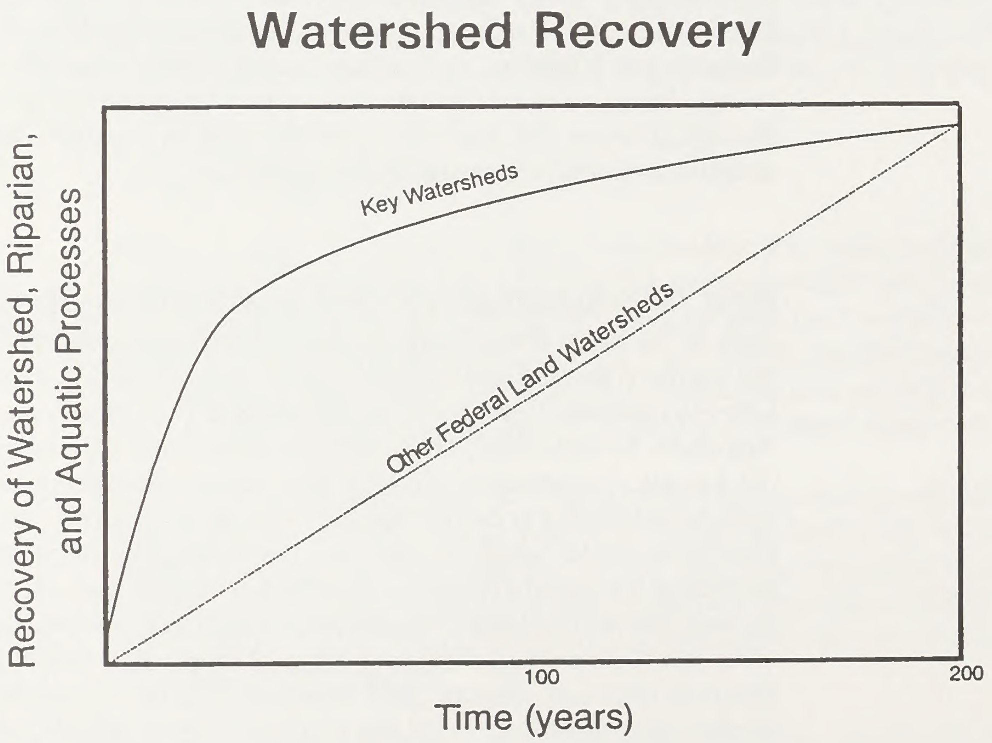


**Figure V-26.** Qualitative depiction of the rate of recovery for Tier 1 Key Watersheds as compared to other Federal land watersheds. Faster recovery is due to the area of reserved lands, Riparian Reserves, and priority for restoration efforts.

federal lands. Interim Riparian Reserves on all permanently flowing streams are wide enough to provide the full suite of ecological functions and include the floodplain, inner gorges, and unstable and potentially unstable lands. For non-Key Watersheds, interim reserve widths for Riparian Reserve scenarios 1 and 2 on intermittent streams are one or one-half site potential tree, respectively. Although these interim Riparian Reserve widths were estimated to be sufficient for providing full ecological effectiveness, the Assessment Team assumed that there would be a greater risk to aquatic systems with the narrower reserves. In addition, the recovery rate may be slower in non-Key than in Key Watersheds due to less area in Late-Successional and other reserves and limited restoration funds.

## Key Watersheds

The Assessment Team indicated that all watersheds will recover watershed, riparian, and aquatic processes, however, Key Watersheds should recover at a faster rate than others (Fig. V-26). The large percent of Key Watersheds in Late-Successional and other reserved acres, interim Riparian Reserves of one site-potential tree on intermittent streams in Tier 1 Key Watersheds, and identification of Key Watersheds as priority sites for restoration increase the recovery rate in Key Watersheds.

The Assessment Team identified a network of 162 Key Watersheds located on federal lands including both Tier 1 Key Watersheds, selected specifically for directly contributing to the conservation of habitat for at-risk anadromous salmonids, bull trout, and resident fish species, and Tier 2 Key Watersheds, which are important sources of high quality water. These Key Watersheds vary in acreage in reserve status by alternative. The 139 Tier 1 Key Watersheds range between 70 to 86 percent in reserve status excluding Riparian Reserves. The 23 Tier 2 Key Watersheds ranged between 62 to 82 percent in reserve status, excluding Riparian Reserves. The Key Watershed network occupies 36 percent of the federal land within the range of the northern spotted owl, or about 8.6 million acres.

Management activities in inventoried roadless areas may increase the risk of aquatic and riparian habitat damage and potentially impair the capacity of Key Watersheds to function as intended and to contribute to achieving Aquatic Conservation Strategy Objectives. In order to protect the best habitat in Key Watersheds, all alternatives except 7 and 8 stipulate no new roads will be constructed in inventoried roadless areas within Key Watersheds and watershed analysis must be completed for all watersheds within which a roadless area lies before management activities proceed in that roadless area.

Over 3 million acres of inventoried roadless areas exist within the National Forests in the range of the northern spotted owl. Over 50 percent of this area is in Key Watersheds, with about 48 percent contained in Tier 1 Key Watersheds.

The potential disturbance to Key Watersheds from activities in inventoried roadless areas can be estimated by calculating the inventoried roadless acres in the general matrix of the northern spotted owl forests where timber harvesting could occur. The percentage of the total inventoried roadless area which is in the matrix varies by alternative from 8 percent for Alternative 1 to 25 percent for Alternative 7. The percentage of the total roadless area that is in the matrix and is suitable for timber harvest ranges from 4 percent in Alternative 1 to 17 percent in Alternative 7. If it is assumed that half of the acreage in the matrix of inventoried roadless areas are in Key Watersheds and may be harvested, then there are an estimated 69,000 acres in roadless areas in Alternative 1 increasing to about 256,000 acres in inventoried roadless areas in Alternative 7 in Key Watersheds where timber harvesting may occur.

Most inventoried roadless acreage available for harvest can be harvested either directly from existing roads or using helicopters. Two miles is considered to be the economically operable distance for helicopter logging at today's lumber prices. Under Alternative 9, between 5,000 and 10,000 acres of matrix available for harvest of all inventoried roadless areas are beyond two miles from a road. The Assessment Team estimated that there were no suitable acres for timber harvest in inventoried roadless acres within Key Watersheds that were further than this distance from existing roads. Thus, the requirement that no road will be constructed in inventoried roadless areas within Key Watersheds should have no impact on total regional probable sale quantity. If all inventoried roadless acres available for harvest remains unroaded in Alternative 9, then the estimated reduction for the total regional probable sale quantity is less than 0.2 percent.

**Possible Mitigation Measures** To protect the remaining high quality habitats, no new roads will be constructed in inventoried roadless areas in Key Watersheds under all alternatives except 7 and 8. The Assessment Team recommends that there be a reduction in existing system and nonsystem road mileage within Key Watersheds. If sufficient funding does not become available for this reduction, there will be no net increase in road mileage in Key Watersheds. That is, if a mile of new road is constructed, at least 1 mile of road shall be decommissioned, with priority for removing roads that pose the greatest risks to riparian and aquatic ecosystems. Watershed analysis must be conducted in all non-Key Watersheds that contain inventoried roadless areas before any land management activities can occur within the inventoried roadless area.

## Threatened, Endangered and Proposed Species

All Federal agencies have responsibilities to further the purposes of the Endangered Species Act (ESA). These responsibilities include, but are not limited to: conservation efforts to recover listed species; provision of means to conserve the ecosystems which listed species depend on; and consultation (or conference) with the Secretary of the Interior on actions which may affect listed species or designated critical habitat (or destroy or adversely modify proposed critical habitat, or jeopardize proposed species). In partial fulfillment of these responsibilities, the BLM and Forest Service conduct Section 7 consultation with the Fish and Wildlife Service and National Marine Fisheries Service. For the purposes of this SEIS, consultation will initially occur on the selection of an alternative "to adopt a coordinated management direction for the lands administered by the Forest Service and Bureau of Land Management within the range of the northern spotted owl to maintain populations of late-successional and old-growth forest related species." Additional consultation will occur as deemed appropriate, or when local or province planning occurs and impacts to listed species can be better described and quantified.

The Forest Service and BLM planning documents which are being supplemented by this SEIS contain lists and discussions of threatened, endangered, proposed, candidate and "special status" species. In this supplement, the lists of threatened, endangered and proposed species are updated and combined. While candidate and other special status species will not be addressed in this document, they will be addressed in the Forest Plans and BLM RMPs which have been prepared, or will be prepared following this SEIS.

The Fish and Wildlife Service and National Marine Fisheries Service provided a list of 43 federally listed and proposed species which may occur in the range of the northern spotted owl (Table 3&4-5). The species list from the Fish and Wildlife Service also identified nine species whose habitat associations are known to include late-successional forest or are directly associated with such habitat. With this information, a portion of the listed and proposed species can be eliminated from detailed discussion in this SEIS for one of four reasons: 1) they are not known to occur on the Federal lands of the planning area, 2) they do not inhabit coniferous forests, 3) their use of coniferous forests is not dependent on old-growth conditions, or 4) their presence in the spotted owl's range is transitory or unaffected by forest management activities. The alternatives considered in this SEIS will have no effect on these species, as noted in Table 3&4-5.

### LISTED AND PROPOSED SPECIES INDIRECTLY ASSOCIATED WITH LATE-SUCCESSIONAL FORESTS

The Fish and Wildlife Service identified those "species that are not restricted to only late-successional forests or that are associated with unique or specialized habitats that may not be considered late successional, but which may be affected by forest management activities". Some of these species were not evaluated by the Assessment Team because of their lack of association with late-successional forests, however, they are addressed here to provide a complete accounting.

## Grizzly Bear

**AFFECTED ENVIRONMENT** The grizzly bear is federally-listed as threatened. Its current range includes a portion of the planning area, including the National Forests in the Cascade Range in Washington. There is currently no recovery plan for the population in Washington, though recovery planning is underway.

While grizzly bears are not closely associated with late-successional forests, they inhabit vast, diverse, and remote mountainous areas and avoid human disturbance. They use a variety of vegetation types for foraging and other life functions. These habitats include open areas such as lowland wet meadows and marshes, shrub fields, high-elevation sedge or heath meadows, and stream floodplains. Forested areas are used for resting and hiding cover, as well as for foraging.

**EFFECTS OF ALTERNATIVES** Adoption of any of the alternatives is not likely to adversely affect grizzly bears. The Assessment Team did not address the grizzly bear because of this species' lack of dependence on old-growth forests. It was their determination that effects of forest management activities on the bear were not tied to the amount or distribution of old-growth forests on Federal lands. Instead, the effects on grizzly bear recovery will depend on implementation of the selected alternatives and mitigation measures. This is based on the documented knowledge that grizzlies avoid human contact and spend a disproportionate amount of time in remote areas. Therefore, roads which are left open to vehicle traffic constitute forest management's major effect on grizzly bears. Human access which occurs following road construction disturbs the bears' normal behavior patterns and exposes them to illegal hunting or accidental shooting.

**POSSIBLE MITIGATION MEASURES** Regardless of the alternative selected, future Federal projects (such as timber sales) will be required to enter Section 7 consultation. At that time in project-level planning, the disturbance effects on grizzlies may be identified and mitigated with road closures. The ongoing grizzly bear recovery planning efforts will identify additional conservation measures which can be addressed in the appropriate Federal land planning document.

Table 3&4 - 5. Federally-listed threatened, endangered and proposed species which may occur in the range of the northern spotted owl on National Forests and BLM Districts included in this analysis.

| STATUS | OCCURENCE | IMPORTANT HABITAT NEEDS | CRIT. HAB* | EFF. ** |
|---|---|---|---|---|
| **ENDANGERED SPECIES** | | | | |
| Brown Pelican<br>*(Pelecanus occidentalis)* | Documented on Siuslaw Forest. | Beaches and offshore islands. | No | NE |
| American Peregrine Falcon<br>*(Falco peregrinus anatum)* | Throughout planning area. | Cliffs/bluffs with suitable nesting ledges; prey base important yearround. | No | ME |
| Northern Bald Eagle (Ca.)<br>*(Haliaeetus leucocephalus)* | Throughout planning area. | Nests and roosts in large old-growth trees near water. | No | ME |
| Gray Wolf<br>*(Canis lupus)* | Documented on Gifford Pinchot, Mt. Baker-Snoqualmie, Wenatchee, and Okanogan Forests; unverified sightings in Oregon Cascades and Rogue River areas. | Many habitat types uses; prey base and seclusion important. | No | ME |
| Point Arena Mountain Beaver<br>*(Aplodontis rufa nigra)* | Mendocino County, California;<br>not known on federal lands. | Coastal scrub, coniferous forest, riparian and stabilized dunes. | No | NE |
| Columbian White-tailed Deer<br>*(Odocoileus virginianus leucurus)* | Roseburg BLM District; other lands outside of planning area. | Riparian habitat in coniferous forests. | No | ME |
| Klamath Short-Nosed Sucker<br>*(Chasmistes brevirontris)* | Documented on Winema Forest, suspected on Klamath Forest. | Aquatic | No | ME |
| Lost River Sucker<br>*(Deltistes luxatus)* | Documented on Winema National Forest | Aquatic | No | ME |
| Modoc Sucker<br>*(Catostomus microps)* | | Aquatic | No | ME |
| Snake River Sockeye Salmon<br>*(Oncorhynchus nerka)* | Columbia River through planning area. | Aquatic | No | NE |
| Leatherback Sea Turtle<br>*(Dermochelys coriacea)* | Ocean adjacent to planning area. | Ocean | No | NE |
| Shasta Crayfish<br>*(Paciastacus fortis)* | Documented on Lassen and Shasta-Trinity National Forests. | Aquatic | No | NE |
| California Freshwater Shrimp<br>*(Syncaris pacifica)* | Does not occur on Forest Service or BLM lands. | Aquatic | No | NE |
| Myrtle's Silverspot Butterfly<br>*(Speyeria zerene myrtleae)* | Does not occur on Forest Service or BLM lands. | | No | NE |
| Lotis Blue Butterfly<br>*(Incisalia mossii bayensis)* | Does not occur on Forest Service or BLM lands. | | No | NE |
| MacDonald's Rockcress<br>*(Arabis macdonaldiana)* | Documented on Arcata BLM District; suspected on Six Rivers Forest. | Serpentine soils | No | ME |

Table 3&4 - 5. (continued)

| STATUS | OCCURENCE | IMPORTANT HABITAT NEEDS | CRIT. HAB* | EFF. ** |
|---|---|---|---|---|
| **THREATENED SPECIES** | | | | |
| Northern Bald Eagle (OR, WA) *(Haliaeetus leucocephalus)* | All lands in planning area. | Nests and roosts in large old-trees near water. | No | ME |
| Aleutian Canada Goose *(Branta canadensis leucopareia)* | Documented on Siuslaw Forest and Coos Bay District. | Wintering habitat - wetlands, open areas, large bodies of water. | No | NE |
| Northern Spotted Owl *(Strix occidentalis caurina)* | Throughout planning area. | Coniferous forests, late-successional preferred. | Yes | ME |
| Western Snowy Plover *(Charadrius alexandrinus novisus)* | | Coastal dunes. | No | NE |
| Marbled Murrelet *(Brachyramphus marmoratus)* | Documented on Mt. Baker-Snoqualmie, Olympic, Siuslaw, Siskiyou and Six Rivers Forests, Coos Bay, Salem, Eugene BLM Districts. | Nests on moss and lichen-covered large lateral branches of old-growth trees, generally within 50 miles of salt water. | No | ME |
| Grizzly Bear *(Ursus arctos)* | Documented on Mt. Baker-Snoqualmie, Okanogan and Wenatchee Forests. | Many habitat types used; food sources, seclusion important. | No | ME |
| Northern Sea Lion *(Eumetopias jubatus)* | Ocean adjacent to planning area. | Ocean | No | NE |
| Warner sucker *(Catostomus warnerensis)* | Does not occur on Forest Service or BLM lands. | Aquatic | No | NE |
| Sacramento River winter Chinook Salmon *(Oncorhynchus tshawytscha)* | | Ocean/freshwater aquatic | No | NE |
| Snake River spring/summer Chinook Salmon *(Oncorhynchus tshawytscha)* | Columbia River through planning area. | Ocean/freshwater aquatic | No | NE |
| Snake River fall Chinook Salmon *(Oncoryhnchus tshawytscha)* | Columbia River through planning area. | Ocean/freshwater aquatic | No | NE |
| Green Sea Turtle *(Chelonia mydas)* | Ocean adjacent to planning area. | Ocean | No | NE |
| Loggerhead Sea Turtle *(Caretta caretta)* | Ocean adjacent to planning area. | Ocean | No | NE |
| Olive Ridley Sea Turtle *(Lepidochelys olivacea)* | Ocean adjacent to planning area. | Ocean | No | NE |
| Valley Elderberry Longhorn Beetle *(Desmocerus californicus dimorphus)* | Mendocino, Shasta-Trinity, Lassen National Forests and BLM lands. | | No | NE |
| Behren's Silverspot Butterfly *(Speyeria zerene behrensii)* | Does not occur on Forest Service or BLM lands. | | No | NE |
| Oregon Silverspot Butterfly *(Speyeria zerene hippolyta)* | | Restricted to salt-spray meadows and adjacent forests. | Yes | ME |

Table 3&4 - 5. (continued)

| STATUS | OCCURENCE | IMPORTANT HABITAT NEEDS | CRIT. HAB* | EFF. ** |
|---|---|---|---|---|
| **PROPOSED SPECIES** | | | | |
| Oregon Chub<br>*(Oregonichthys crameri)* | | Aquatic | No | ME |
| Vernal Pool Fairy Shrimp<br>*(Branchinecta lynchi)* | Does not occur on Forest Service or BLM lands. | Aquatic | No | NE |
| Vernal Pool Tadpole Shrimp<br>*(Lepidurus packardi)* | Does not occur on Forest Service or BLM lands. | Aquatic | No | NE |
| California Linderiella<br>*(Linderiella occidentalis)* | Does nto occur on Forest Service or BLM lands. | Aquatic | No | NE |
| Conservancy Fairy Shrimp<br>*(Branchinecta conservatio)* | Does not occur on Forest Service or BLM lands. | Aquatic | No | NE |
| Western Lily<br>*(Lilium occidentale)* | Coastal Oregon and California; not known on federal lands. | Sphagnum bogs, coastal scrub and prairies. | No | NE |
| Nelson's sidalcea<br>*(Sidalcea nelsoniana)* | | | | |
| Applegate's Milk-vetch<br>*(Astragalus applegatei)* | Klamath County, Oregon; not known on federal lands. | Seasonally moist alkaline grasslands. | | |
| Water Howellia<br>*(Howellia aquatilis)* | | | | |
| Marsh sandwort<br>*(Arenaria paludicola)* | | | | |

* CRITICAL HABITAT - whether or not critical habitat for this species exists on Forest Service or BLM lands within the range of the northern spotted owl (Y=yes; N=no).
**EFFECTS - initial conclusion as to whether adoption of the alternatives considered would effect the survival and/or recovery of the species (NE=no effect;ME=may effect, not likely to adversely affect - further Section 7 review is expected as plan is implemented).

## Gray Wolf

**Affected Environment** The gray wolf is federally listed as endangered. Its current distribution includes the northern Cascade Range in Washington. There is no recovery plan for the population in Washington; a recovery plan is being developed.

Like the grizzly bear, the gray wolf is not closely associated with late-successional forests. Forested and open habitats supporting deer and elk populations, which are their major prey, are the primary requirements of the gray wolf. Areas that support small mammal populations are important at times of the year when large prey are not available. Wolves are documented to avoid human contact and spend a disproportionate amount of time in remote areas, especially when raising young at den sites.

**Effects of Alternatives** The Assessment Team did not address gray wolves because of this species' lack of dependence on old-growth forests. As with the grizzly bear, it was the Assessment Team's determination that wolves would do equally well in all options, and the effects of forest management activities on wolf conservation are not tied to the amount or distribution of old-growth retained on

Federal lands. Instead, the effects of the alternatives on wolf recovery will depend on implementation actions which create or maintain remote habitat and important prey populations. This conclusion is based on the initial information provided by the wolf recovery efforts and knowledge of wolf ecology. Therefore, roads which are left open to traffic, either existing or to be constructed, constitute forest management's major effect on gray wolves. Human access which occurs following road construction disturbs the wolves normal behavior patterns and exposes them to illegal hunting or accidental shooting.

Regardless of the alternative selected, there is not likely to be an adverse affect to gray wolves.

**Possible Mitigation Measures** Continuing wolf recovery planning efforts will identify additional measures which can be taken to improve wolf conservation under the selected alternative. The National Forest Plan amendments will further address appropriate wolf recovery objectives and actions.

### Peregrine Falcon

**Affected Environment** The peregrine falcon is federally listed as endangered. Both breeding and wintering populations occur throughout the planning area. The Pacific States Peregrine Falcon Recovery Plan includes recommendations for management for the species. Forest Service and BLM management direction follows the Recovery Plan and this direction will continue.

While the peregrine falcon is not closely associated with late-successional forests, it often nests on cliffs that are situated among coniferous forests. It forages in and around coniferous forests, and its diverse prey base is often associated with openings around forested areas.

**Effects of Alternatives** The Peregrine Falcon Recovery Plan describes protection measures which are followed by both the Forest Service and BLM. Therefore, regardless of the alternative selected, peregrine falcon conservation will continue. Individual Forest Plan amendments and BLM RMPs will further address the needs for peregrine recovery. None of the alternatives is likely to adversely affect the peregrine falcon.

**Possible Mitigation Measures** None required; continued compliance with the Peregrine Falcon Recovery Plan will be adequate.

### Sacramento River Winter Chinook Salmon

**Affected Environment** This stock of chinook salmon is listed as threatened throughout the Sacramento river system. A recovery plan for this stock of fish has been completed and critical habitat has been designated.

The major spawning areas for this species occur outside of coniferous forests. Before the construction of Shasta Dam, this stock of salmon spawned throughout the upper tributaries of the Sacramento River. The Assessment Team stated, "Forest management practices along the tributaries to the west of the mainstem below the reservoir could have an influence on the species." However, few, if any, Federal forest lands occur here. The major factors that affect the species are probably the allocation of water flows from Shasta Reservoir, withdrawal of water from the river for irrigation, and harvesting of the fish at sea.

**Effects of the Alternatives** Regardless of the alternative selected, the Federal agencies will consult the Recovery Plan for direction. The alternatives are not likely to adversely affect Sacramento River winter chinook salmon.

**Possible Mitigation Measures** None required; continued compliance with the Sacramento River Winter Chinook Recovery Plan will be adequate.

Snake River Fall Chinook Salmon, Snake River Spring/Summer Chinook Salmon, and Snake River Sockeye Salmon

**Affected Environment** These anadromous species migrate in the Columbia river through the range of the northern spotted owl to reach their spawning areas in Idaho.

Effects of the Alternatives Significant threats to all these anadromous species are issues which are unrelated to Federal forest management in the northern spotted owl's range. For this reason, the Assessment Team did not include these three species in their viability panel assessments. Also, because these threats are not within the purview of this SEIS, these species will not be addressed in detail in this document.

In preparation of the Final Environmental Impact Statement (USDA 1992), the Forest Service determined that ".. the Snake River sockeye and chinook salmon will not be adversely affected by any of the alternatives evaluated in this Environmental impact statement. In a letter from the National Marine Fisheries Service dated January 7, 1992, the Service indicated that they concur with this determination." The additional alternatives which are being considered in this SEIS are also determined not likely to adversely affect Snake River fall chinook, Snake River spring/summer chinook and Snake River sockeye salmon.

### Klamath Short-Nose Sucker and Lost River Sucker

**Affected Environment** These suckers are found in the Klamath Lake Basin; their presence on Federal lands occurs on the Winema and Fremont National Forests and the BLM Lakeview District. They live in the lakes and some streams, but migrate into rivers to spawn. The primary threats come from management of nonfederal lands, including: loss of habitat due to alteration of the rivers in which they spawn, diversion of water into canals through unscreened diversions, lowering of flows in the rivers in which they spawn, and the lowering and eutrophication of Klamath Lake.

**Effects of the Alternatives** Alternative 7 would have a greater potential for adverse effects to these two species, due to the narrower stream buffers in this alternative. The remaining alternatives are not likely to adversely affect the species.

### MacDonald's Rockcress

**Affected Environment** MacDonald's rockcress is listed federally as endangered, and a recovery plan is completed. The species is known to occur on lands administered by the BLM in the Arcata Resource Area and is assumed to occur on the Six Rivers National Forest, though identification of plants collected there is being reviewed. Both the Forest Service and BLM are currently managing the known and suspected sites on Federal lands in accordance with the Recovery Plan.

MacDonald's rockcress occurs on barren to shrub-covered, rocky, and serpentine soils associated with Jeffrey pine woodlands, which range from 3,500-4,000 feet in elevation in Del Norte and Mendocino Counties, California (Matthews et al. 1990). These soils do not typically produce stands of commercial timber due to low site productivity. However, salvage sales and related activities plus development of rock quarries for roads present potential threats to this species (Foster 1992). Mining of nickel-rich soils has posed the greatest threat to the species and was the primary concern cited in the original listing (USDI 1978).

**Effects of Alternatives** The Arcata Resource Management Plan identifies the Red Mountain area, where the MacDonald's rockcress is found, as an Area of Critical Environmental Concern. This identification will give the plant additional management protection, beyond its listing protection. All of the alternatives are not likely to adversely affect the MacDonald's rockcress.

**Possible Mitigation Measures** None required; continued compliance with the Recovery Plan will adequately provide for this species.

### LISTED AND PROPOSED SPECIES ASSOCIATED WITH LATE-SUCCESSIONAL FORESTS

#### Bald Eagle

**Affected Environment** The bald eagle is federally listed as threatened in Washington and Oregon and endangered in California. Breeding and wintering populations occur throughout the planning area and are addressed in the Pacific Bald Eagle Recovery Plan (USDI 1986). Current Forest Service and BLM management direction follows the Recovery Plan.

Prey of the bald eagle consists primarily of fish during the breeding season and waterfowl or carrion during the fall and winter. As a result, the species foraging is closely tied to water habitats. However, bald eagles nest in forested habitats, and these areas are often in old-growth forests or forests that possess components of old-growth forests. The eagles roost communally (usually during winter) in these same habitat types. These nesting and roosting areas are considered essential habitat features for the species.

**Effects of Alternatives** The Pacific Bald Eagle Recovery Plan recognizes the importance of older forests in providing nesting and roosting habitat for bald eagles, and the plan restricts timber harvest in these areas. The BLM and Forest Service currently follow guidance in the Recovery Plan and this direction will continue. Therefore, regardless of the alternative selected, bald eagle conservation will continue. As a result, the Assessment Team concluded that bald eagles would have a 100 percent likelihood of outcome A (occurring well distributed on Federal lands). The expected improvement in riparian habitat and water quality which will result from all alternatives except Alternative 7, will be beneficial to bald eagle recovery by providing an increasing number of potential nest sites and improved prey base. None of the alternatives is likely to adversely affect bald eagles.

**Possible Mitigation Measures** None required other than continued compliance with Recovery Plan.

## Northern Spotted Owl

Affected Environment The northern spotted owl was federally-listed as threatened in 1990 (USDI 1990). Extensive studies of the owl during the last 20 years have shown it to be strongly associated with late-successional forests throughout much of its range. In northern California and on the east slope of the Cascade Range in Washington, the spotted owl is also fairly common in some types of relatively young forest, especially where those forests are structurally similar to older forests.

Northern spotted owls nest in cavities or platforms in trees. They feed on a variety of forest mammals, birds, and insects. They are long-lived, territorial birds, often spending their entire adult life in the same territory. In high quality habitat, pairs are typically spaced about 1-2 miles apart.

Data summarized by the U.S. Department of the Interior Spotted Owl Recovery Team indicated that spotted owls were located at approximately 4,600 sites between 1987-1991, including confirmed pairs at 3,602 sites, and territorial single owls at 957 sites. The actual population is undoubtedly larger than the number of individuals confirmed, because a significant portion of the range of the owl has yet to be surveyed (Thomas et al. 1993). Although the majority of spotted owls occur on Federal lands, significant numbers also occur on private lands, especially in northwestern California.

Effects of Alternatives The effectiveness of an alternative in providing for spotted owl recovery on Federal lands relies heavily on the spacing, size and location of the habitat. These measures are based on the scientific work which began with the Interagency Scientific Committee (ISC) Conservation Strategy and was further developed in the Northern Spotted Owl Recovery Plan. The spotted owl assessment panel convened by the Assessment Team reconfirmed the need for "...a significant network of late successional reserves and ... conditions adequate for dispersal of owls..." (Appendix A, Terrestrial Forest Ecosystem Assessment). The FEMAT Report includes a series of tables illustrating numbers of owls and owl habitat which would be protected under each of the alternatives.

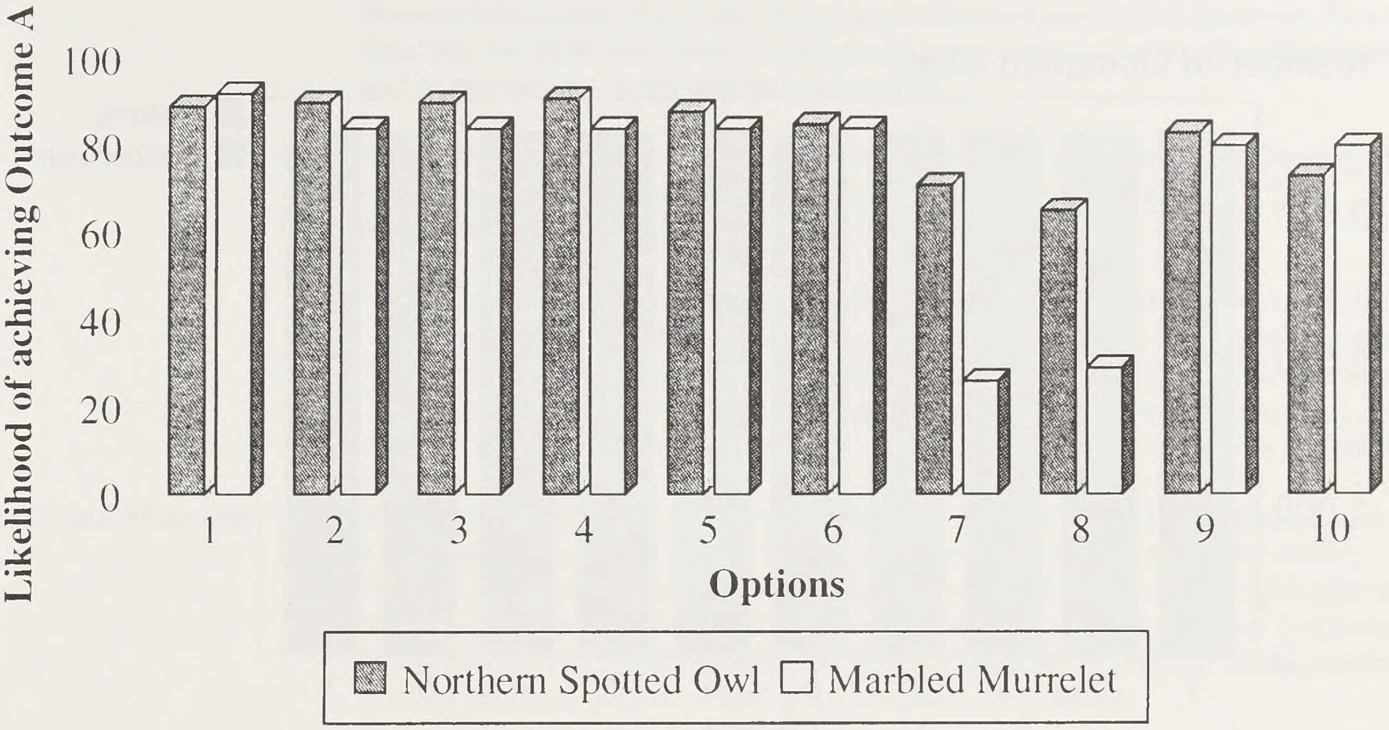
Northern spotted owl expert panel results:

> *Options [Alternatives] 1 through 6 and 9 all had a greater than 80 percent likelihood of achieving outcome A (Table IV-26). Options 7, 8 and 10 received scores of 71, 65 and 73, respectively, for outcome A. No likelihood points were assigned to outcome D (extirpation on Federal lands) for any of the seven options. (Figure II-8a)*

It was the conclusion of the Assessment Team that Alternatives 1 through 6 and 9 met or exceeded the conservation measures for Federal lands for the *Final Draft of the Northern Spotted Owl Recovery Plan.* Alternatives 7, 8 and 10 were found to have less assurance of owl recovery on Federal lands.

Considering the Assessment Team's results and the proportion of spotted owl sites protected, by alternative, there is a range of protection which would occur for known spotted owl sites in the short term (next fifty years) (Figure IV-17 ). The range is from 55 percent of owl sites protected under Alternative 7, to 89 percent of sites in Alternative 1. These estimates are for owl sites protected in Late-Successional Reserves, managed reserves and Adaptive Management Areas only. It

**Figure II-8a** Likelihood of achieving habitat Outcome A (Habitat suitable to maintain viable populations well-distributed on federal lands). Likelihood for Options 2, 6, and 10 are internal assessments; these Options were not related by expert panels.



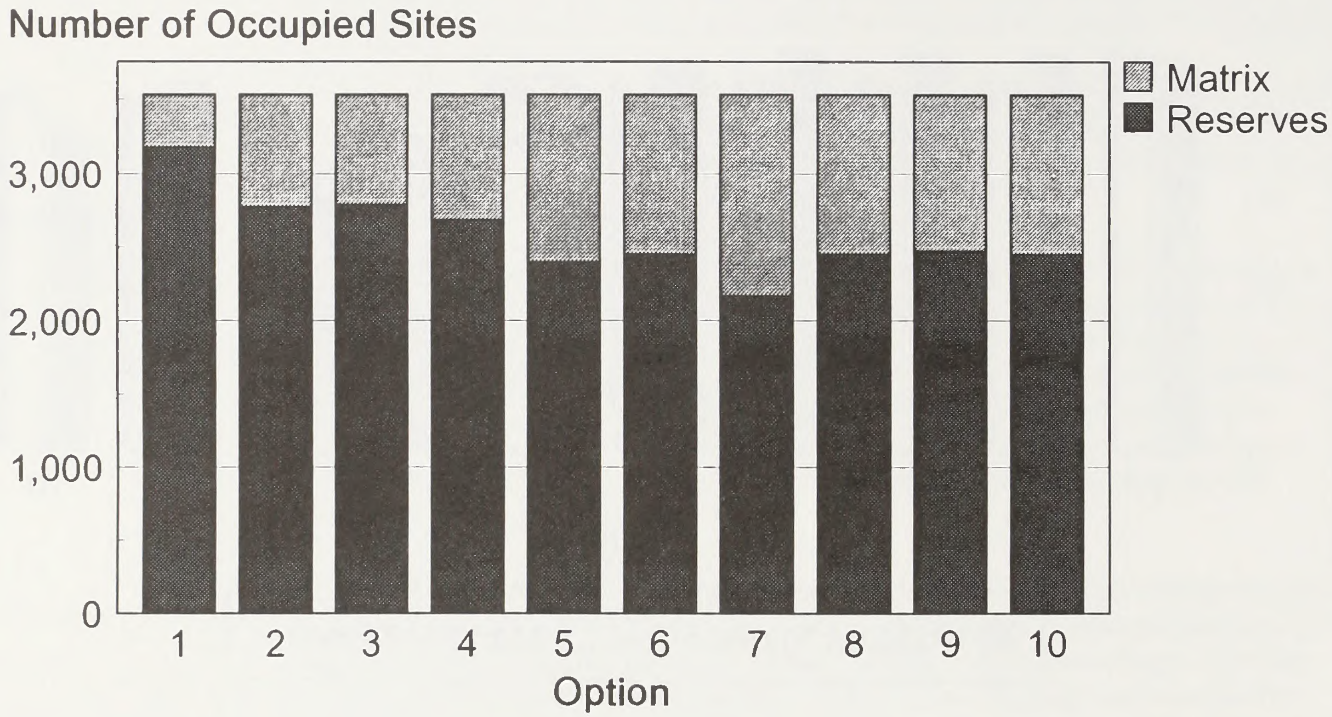
is unknown at this time how many additional owl locations would be protected from timber harvest as a result of their location in riparian reserves in matrix. However, based on the protection of sites in reserves, and matrix management provisions, Alternatives 1 through 10 are not likely impair the ability to achieve recovery of northern spotted owls.

Figure IV-17 Number of currently confirmed sites occupied by northern spotted owls within Reserve Areas and the matrix, by alternative. For this comparison, occupied sites in Managed Late-Successional Areas (Alternative 3) and Adaptive Management Areas (Alternative 9) were included in the count of sites in reserves.

In their report, the Assessment Team provides additional discussion of the expected short-term effects of the alternatives on spotted owl populations. Their discussion focuses on the probable spotted owl population response up to 150 years from implementation of the selected alternative (see Appendix A, Terrestrial Forest Ecosystem Assessment for a full discussion):

> **Consideration of specific concerns about short-term effects, including the so-called "transition period"**
>
> **Habitat Trends**
>
> *Because some spotted owls occur outside Late-Successional Reserves, and use forests younger than 80 years old, at least some of their habitat inevitably will be harvested no*

**Figure IV-17** Number of currently confirmed sites occupied by northern spotted owls within Reserve Areas and Matrix areas by management option. For this comparison occupied sites in Managed Late-Successional Areas (Option 3) and Adaptive Management Areas (Option 9) were included in the count of sites in Reserves.



*matter which option is chosen. Thus, habitat for spotted owls will likely continue to decline in the near future. Over the long term, most of the options will eventually produce substantially more suitable habitat for northern spotted owls and marbled murrelets than currently exists, and that habitat will be in larger blocks than at present. The current lanscape is characterized by highly fragmented blocks of late-successional forest interspersed with young, managed stands that are mostly less than 50 years of age. these young, managed stands will require considerable time to develop into suitable nesting habitat for marbled murrelets...*

*One concern that has been expressed regarding the spotted owl and marbled murrelet is that existing levels of fragmentation within Late-Successional/Old-Growth Reserves, together with high rates of habitat loss in the matrix, could result in such rapid population declines during the transition period that populations will not be able to stabilize at a new equilibrium level once habitat within the Reserves is regenerated. For the spotted owl and marbled murrelet the critical transition period will likely occur during the first 50-150 years after a management plan is implemented (Thomas et al. 1990, McKelvey 1992, McKelvey et al. 1993). After that time, most cutover areas within Reserves will have assumed old-forest characteristics, and levels of fragmentation will have been greatly reduced...*

*Of the seven options, options for which we did full assessments 1, 3, 4, 5, and 9 included more protection of Riparian Reserves and Late-Successional/Old-Growth Reserves than previous plans proposed for the spotted owl (Thomas et al. 1990). These*

> *additional levels of protection should provide additional habitat for spotted owls, reducing the magnitude of any demographic or habitat 'bottleneck' that might occur during the transition period.*

**Possible Mitigation Measures** When the Northern Spotted Owl Recovery Plan is finalized, the BLM and Forest Service could review the document for refinements and improvements to the selected alternative.

**Role of Nonfederal Lands** The *Final Draft of the Northern Spotted Owl Recovery Plan* restated the need for nonfederal contributions to spotted owl recovery. The Assessment Team stated,

> *In all options [alternatives], we recognize areas of special concern where current habitat conditions on federal lands are deficient in portions of the owl's range, or where private, state, and federal lands are intermingled or federal lands are absent. In these areas of special concern, contributions by nonfederal lands remain important to recovery of the species and should be addressed in the final recovery plan for the northern spotted owl.*

## Marbled Murrelet

**Affected Environment** The marbled murrelet is a seabird that nests inland, and therefore is influenced by both marine and terrestrial environments. Its nesting range extends outside of the range of the northern spotted owl. The Federal lands in old-growth condition were identified by the Assessment Team as a key component of any marbled murrelet management strategy because the loss of nesting habitat was the principal reason for listing the species as threatened.

The typical marbled murrelet nest is a shallow depression hollowed out in moss or other debris, on a broad limb in the upper canopy of large trees. Observations of murrelet nests indicate high mortality of nestlings from predation by corvids (jays, crows, ravens). Fragmentation of old forests may increase the likelihood of predation by making murrelets and their nests more visible to predators.

Based on current estimates of marbled murrelet population size for Washington, Oregon, and California, the three-state area has considerably lower numbers of murrelets than other areas within the species' range (e.g., British Columbia and Alaska). During the last century, there has been a substantial reduction in the amount of old-growth forests within the range of the marbled murrelet, especially at lower elevations in the coastal lowlands of Washington, Oregon, and California.

**Effects of the Alternatives** In the short term, the alternatives will provide a varying degree of "reserve" protection for the population of murrelets known to occur on BLM and Forest Service-administered lands in the planning area. However, eight alternatives (all but Alternatives 7 and 8) provide for protection of murrelet sites outside of the reserves. The full impact of this protection outside reserves is not known at this time because of the limited surveys conducted for this species. There may be many murrelet sites in the matrix which have not yet been discovered. Also, the number of known occupied sites within reserves will undoubtedly increase as further surveys are conducted.

Over the long term, most of the alternatives would eventually produce substantially more suitable habitat for marbled murrelets than currently exists, and that habitat would be in larger blocks (which is preferable for this species). The current landscape is characterized by highly fragmented blocks of late-successional forest interspersed with young managed stands that are generally less than 50 years old. Young managed stands are expected to require considerable time to develop into suitable nesting habitat for marbled murrelets.

The panel of experts assigned by the Assessment Team to review murrelet viability conducted two separate appraisals of the options (alternatives). This was deemed necessary because the survival of the murrelet is expected to be dependent on several issues which are unrelated to Federal forest management. One assessment reviewed the Federal habitat situation, while the other considered the Federal habitat within the context of the wider range of murrelet issues (see Role of Nonfederal Lands). The Assessment Team provided the following conclusion with consideration of the marbled murrelet panel results:

Based on the assessment of habitat conditions, Options [Alternatives] 1-6, 9, and 10 had an 80 percent or greater likelihood of achieving outcome A. Likelihoods of achieving outcome A under options 7 and 8, were 26 and 29 percent, respectively. (Figure II-8a)

These results are based, in large part, on the fact that Alternatives 1 through 6 and 10 meet or exceed the recommendations of the murrelet working team. Alternative 9 includes a modification of the working team's recommendations. Because Alternatives 7 and 8 did not include the recommendations, they are considered far less protective of murrelets.

Other factors important to murrelet recovery, not within the authority of this SEIS (e.g., nesting habitat on nonfederal lands, mortality associated with gill-net fisheries and contaminants, prey population conditions) must be addressed in other planning documents, such as the Murrelet Recovery Plan.

**POSSIBLE MITIGATION MEASURES** When completed, marbled murrelet recovery plan recommendations could be incorporated into Forest Service and BLM planning documents.

**ROLE OF NONFEDERAL LANDS** The [separate] assessment of population viability indicated much greater risk to murrelets than the assessment based only on habitat. When all factors affecting the species are taken into account, including at-sea conditions and land ownership patterns, the Assessment Team concluded there is only about a 60 percent likelihood (with a range of 50 to 75 percent) that the murrelet population on Federal lands will be stable and well distributed after 100 years, regardless of which option is selected.

The greatest concern with marbled murrelets is maintaining the species over the next 50-100 years. This concern relates to both inland nesting habitat and possible adverse impacts in the marine environment. An ecosystem plan constrained to Federal lands contributes to only one aspect of the marbled murrelet's life history requirements. With the marbled murrelet, both the marine environment [because the marbled murrelet is a seabird] and the contribution of state and private lands for nesting habitat must be considered in any viability assessment on Federal lands, even though those factors are mostly beyond the control of Federal land managers.

## Species not Threatened or Endangered

### NONVASCULAR PLANTS AND ALLIES

### Bryophytes

**AFFECTED ENVIRONMENT** Hornworts, liverworts, and mosses, collectively known as bryophytes, are small, green, nonvascular, spore-bearing plants that include a wide array of species well adapted to nearly every habitat on earth. About 170 species of liverworts and 450 species of mosses occur within the range of the northern spotted owl. About 20 percent of these species are endemic to western North America or the Pacific Northwest (Lawton 1971).

See Appendix A, Terrestrial Forest Ecosystem Assessment, for greater discussion of affected environment.

**ENVIRONMENTAL CONSEQUENCES**

**Methodology** An assessment panel considered 106 species that were considered closely associated with old-growth forests, including 32 species endemic to Western North America or the Pacific Northwest (Table IV-A-3, Appendix A). Bryophytes were divided into 13 habitat groups to facilitate discussion (Table IV-A-3, Appendix A). Groups were based on ecological relationships or habitat associations, and some of the groups were further subdivided by their degree of rarity. Ratings were based on the likelihood of an alternative providing sufficient habitat conditions on Federal lands for the bryophytes species.

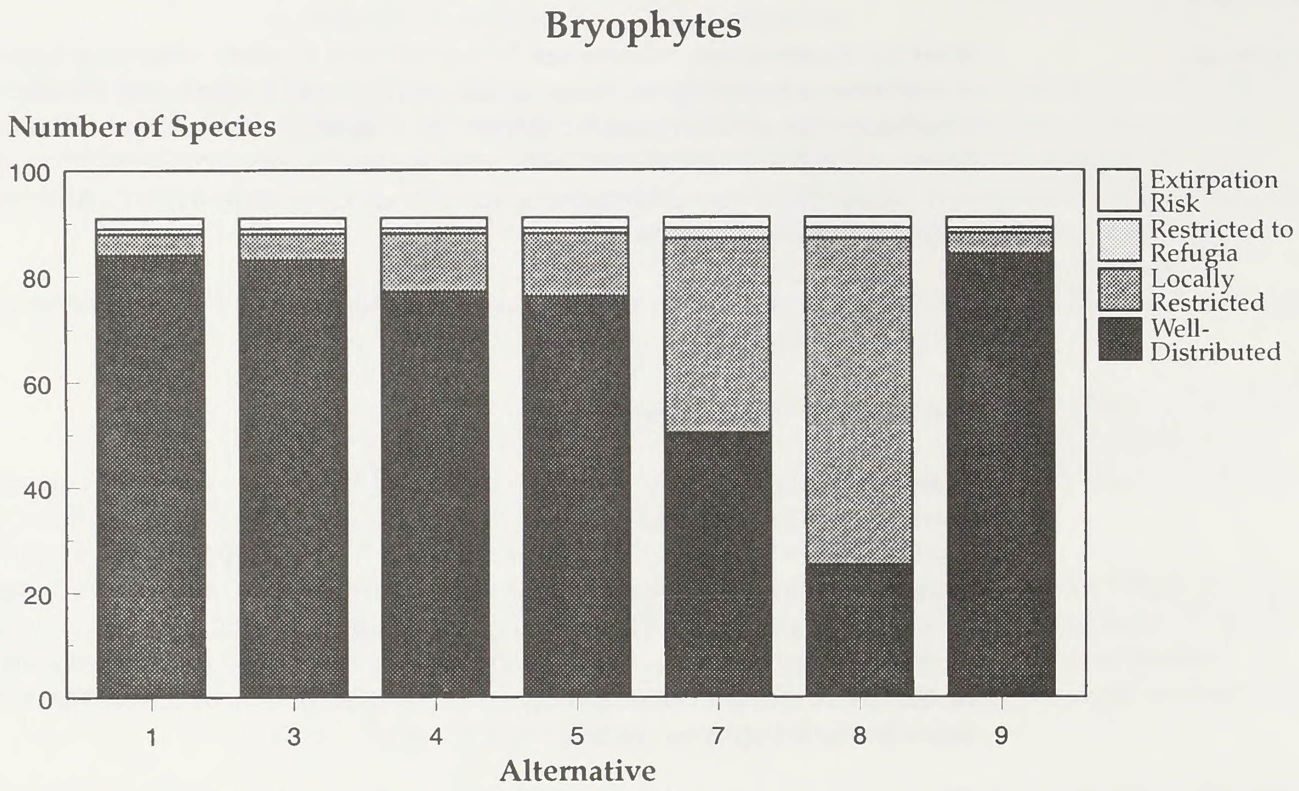
Three species were rated individually because they did not readily fit into species groups or were too poorly known, eight were rated individually because they are rare species, and 16 were not rated because of insufficient information. See the Terrestrial Forest Ecosystem Assessment chapter in Appendix A for a more detailed description of methodology.

**Effects of Alternatives** A summary of outcomes and important habitat features by habitat association groups and for some individual species of bryophytes, for each land management alternative, was based on the average scores of three expert panelists (Figure IV-8, and see Table IV-19, Appendix A). See earlier in this chapter for a full discussion of the assessment panel process.

In general, those alternatives that retained habitat features important to bryophytes associated with late-successional and old growth forests resulted in higher outcomes (Appendix A, Terrestrial Forest Ecosystem Assessment).

Alternatives 1, 3, 4, 5, and 9 consistently rated higher than Alternatives 7 and 8 for most bryophytes (Table IV-19, Appendix A). The riparian prescriptions in all alternatives except 7 and 8 influenced the ratings to be near an 80 percent or greater likelihood of providing habitat of sufficient quality, distribution, and abundance to allow the species population to stabilize, well distributed across Federal lands (outcome A) for the majority of the bryophyte groups. However, riparian buffer widths were often inadequate to protect the bryophytes that occur in the floodplain. Four extremely rare species (Thamnobryum neckeroides, Diplophyllum plicatum,

**Figure IV-8** Outcomes for bryophytes under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).



Marsupella emarginata var. aquatica and Tritomaria exsectiformis) have outcomes of less than 80 percent likelihood of attaining outcome B or better (habitat of sufficient quality, distribution, and abundance to allow the species population to stabilize, but with significant gaps in the historic species distribution). The ratings for these four species do not vary by alternative and are not primarily reflective of alternative design. Under all alternatives these four species would need site specific surveys, analysis and site protection.

The shaded rock outcrops and fog-prone summits were afforded less protection by some of the management alternatives, and the rock and soil associated groups had somewhat lower ratings. These sites are habitat for some of the rarest bryophytes in the region. They are often impacted by ridgeline roads, landings, trails, and telecommunication towers. However, the ratings of these rare species should be accorded less significance because by definition the species already have significant gaps in their distributions, and populations are isolated. In most cases this scattered distribution seems to have been the historical distribution.

**Possible Mitigation Measures** Stream buffer widths could be expanded in riparian prescriptions to encompass the entire floodplain to incorporate the species diversity that exists on stream terraces beyond the buffers. Some roads within floodplains could be removed from the stream terraces. Floodplain stands older than 80 years could remain unthinned or unharvested.

Commercial collecting of moss could be restricted in any of the reserve areas or in the riparian buffers under any of the alternatives. Harvesting of special forest products in the matrix could be regulated for sustained yields.

Mitigation measures for specific bryophyte species groups and species are addressed in Appendix A. These measures could raise the probability of these groups and species attaining outcome A to greater than 80 percent. See Appendix A, Terrestrial Forest Ecosystem Assessment, for a full discussion of suggested mitigation measures.

Intensive inventories could be conducted to locate additional populations of rare species in order to develop species management guidelines. Protection and monitoring of existing rare bryophyte populations are necessary to determine successional status and population trends. Additional forest land along the coast could be managed for old-growth Sitka spruce. Cold springs could be recognized as important resources for biological diversity. Water pollution from sewage and motorboats at Waldo Lake could negatively impact the population of Marsupella emarginata var. aquatica. For Schistostega pennate, windfalls could be left in place to provide structurally diverse habitat. Windfirm buffers of green retention trees along fog-drenched ridges would maintain biological diversity.

## Fungi

AFFECTED ENVIRONMENT Fungi are neither plants nor animals but are recognized as a separate kingdom of organisms both in structure and function. The large number of macrofungi in late-successional and old-growth forests, especially those of uneven-aged structure, reflects the complexity of these ecosystems as well as or better than many other groups of organisms. Estimates indicate there are at least six species of fungi for every vascular plant species in a given temperate ecosystem (Hawksworth 1991).

The fungal flora of the Pacific Northwest is extremely diverse. Of the 527 species of fungi that were evaluated as closely associated with late-successional and old-growth forests, 109 (21 percent) are known to be endemic to the Pacific Northwest (J. Ammirati, J. Trappe, N. Denison, 1993, personal communication).

Many of the forest fungi that produce large fruiting bodies (mushrooms, boletes, corals, etc.) are involved in symbiotic relationships with vascular plants. The survival of most conifers and many flowering plants depends on associations with these mycorrhizal fungi for the uptake of nutrients and water (Trappe and Luoma 1992). Hypogeous fungi (fungi that fruit below ground) and certain mushrooms are important food for small mammals that in turn aid in spore dispersal. These small mammals are also the major prey of northern spotted owls over much of their range (Maser et al. 1978, Ure and Maser 1982). Saprobic fungi (fungi that live on dead or decaying organic matter) are a major component of all forest ecosystems, growing on recently fallen trees, well-decayed logs, litter, dung, etc.. They play an important role in decomposition and recycling of nutrients. For a fuller discussion see Appendix A, Terrestrial Forest Ecosystem Assessment.

## ENVIRONMENTAL CONSEQUENCES

**Methodology** A list of 527 fungi species closely associated with late-successional and old-growth forests on Federal lands, within the geographic range of the northern spotted owl, was developed following the criteria used for the Scientific Analysis Team Report (Thomas et al. 1993). While this is not a complete list, it suggests the high biological diversity of fungi that exist in late-successional and old-growth forests of the Pacific Northwest. There is little published information on the diversity of fungi for the old-growth forests of the Pacific Northwest. Consequently, mycologists contributed to the development of this list based on their research and field experience throughout the region (Appendix A).

The assessment panel evaluated all 527 taxa of fungi (Table IV-A-1, Appendix A). Two major functional divisions of fungi were identified, the ecto-mycorrhizal fungi, and the decomposers or saprobes. Several parasitic species were also included. Overall the species were divided into 36 groups, based on taxonomic and ecological relationships, and their degree of rarity. The species of greatest concern for risk of extirpation were the rare or locally distributed fungi, that comprised 28 percent of the species evaluated.

Each species group was discussed by the assessment panel and fungi species were added or deleted. Groups of species were finalized based on similarity in response to habitat provided on Federal lands by the various management alternatives. The ratings for each group were based on the likelihood of an alternative providing sufficient habitat conditions on Federal lands for the fungi (outcomes A-D, see discussion on assessment panels earlier in this chapter). Twelve species were treated individually because of differences in their biological or ecological attributes. Four species were not evaluated by the assessment panel because of insufficient information and uncertainty about their biology and ecology. In addition, three orders of microfungi representing hundreds of species were discussed by the assessment panel but not evaluated because of lack of information (Appendix A, Terrestrial Forest Ecosystem Assessment).

A summary of outcome scores for each group or species of fungi were based on the average scores of the three panelists (Table IV-17, Appendix A). See also the general discussion of viability analysis assumptions and the process for evaluating and describing the results earlier in this chapter.

**Effects by Alternatives** Projected future likelihoods of habitat for fungi corresponded with the acreage of Late-Successional Reserves and management in the matrix. Ratings for the groups of fungi were based on habitat conditions on Federal lands and varied considerably across the different alternatives. Fungi were rated lower for alternatives that had less acreage of Late-Successional Reserves, fewer old-growth patches, and less coarse woody debris and green tree retention in the matrix. The majority of species evaluated occur on upland sites, so riparian buffers may not be as relevant for many of these fungi as for other organisms. However, fungi associated with riparian areas are not well represented in this evaluation.

**Common Fungi** Most of the common fungi had potential outcomes for habitat being well distributed (outcome A), or well distributed but with significant gaps (outcome B). For Alternative 1, 92 percent of the common fungi groups rated 80 percent likelihood of having habitat of sufficient quality, distribution, and abundance to allow the species population to stabilize, well distributed across Federal lands (outcome A), and 72 percent of the groups received this rating for Alternative 3. Alternatives 4, 5, and 9 had lower ratings with 16-20 percent of the fungi groups rating 80 percent likelihood of outcome A; 8 percent received this rating for Alternatives 7 and 8. See Figure IV-4 for the summary of outcomes for each alternative.

**Rare and Uncommon Species** Rare or uncommon fungi totaled 146 species, or 28 percent of the fungi evaluated and represent the species of greatest concern. The rare and locally endemic species were generally rated with an 80 percent likelihood of outcome C or better (populations being restricted to refugia) which reflects their current distribution, although there was a spread of uncertainty for achieving some level of outcome B or extirpation (outcome D) ( Figure IV-5). For many of these species, there was little difference in ratings across the alternatives. This reflects the relatively random chance that a population will actually occur within a given reserve.

Many of these species are restricted to refugia and are known from only one or a few locations, while others may be more widespread but sporadic in their distribution or abundance. Narrow distribution may be due to inherent life history characteristics, or species requiring specific habitats that are sporadic or rare in the landscape.

**Possible Mitigation Measures** For areas where old-growth stands are limited, additional stands could be identified to allow development into old growth. Stand ages between 80 and 200 years would be necessary to provide suitable habitat and are particularly limited across the planning area.

Maintain a mosaic of diversity across the landscape with respect to host species, age-class distributions, successional stages, habitat structures, habitat types, and topographic positions (i.e., riparian, mid-slope, and ridgetop). Patches could be large enough (5-10 acres at a minimum), not only to provide for habitat needs, but also to lessen the risk of windthrow and to provide suitable microclimate conditions.

Site treatment and soil-disturbing activities such as burning, yarding, and heavy equipment operation could be minimized unless appropriate for certain habitats, communities, or conditions.

Inventory and monitoring could be conducted for rare or locally endemic taxa and known sites protected prior to management activities. Locations and distribution of these species of fungi could be documented and maintained in a Geographic Information System. All type localities could be preserved, especially those of rare taxa. A type locality is the site where the original material of a species was collected. The type collection forms the basis for defining that species.

**Figure IV-4** Outcomes for common fungi under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).

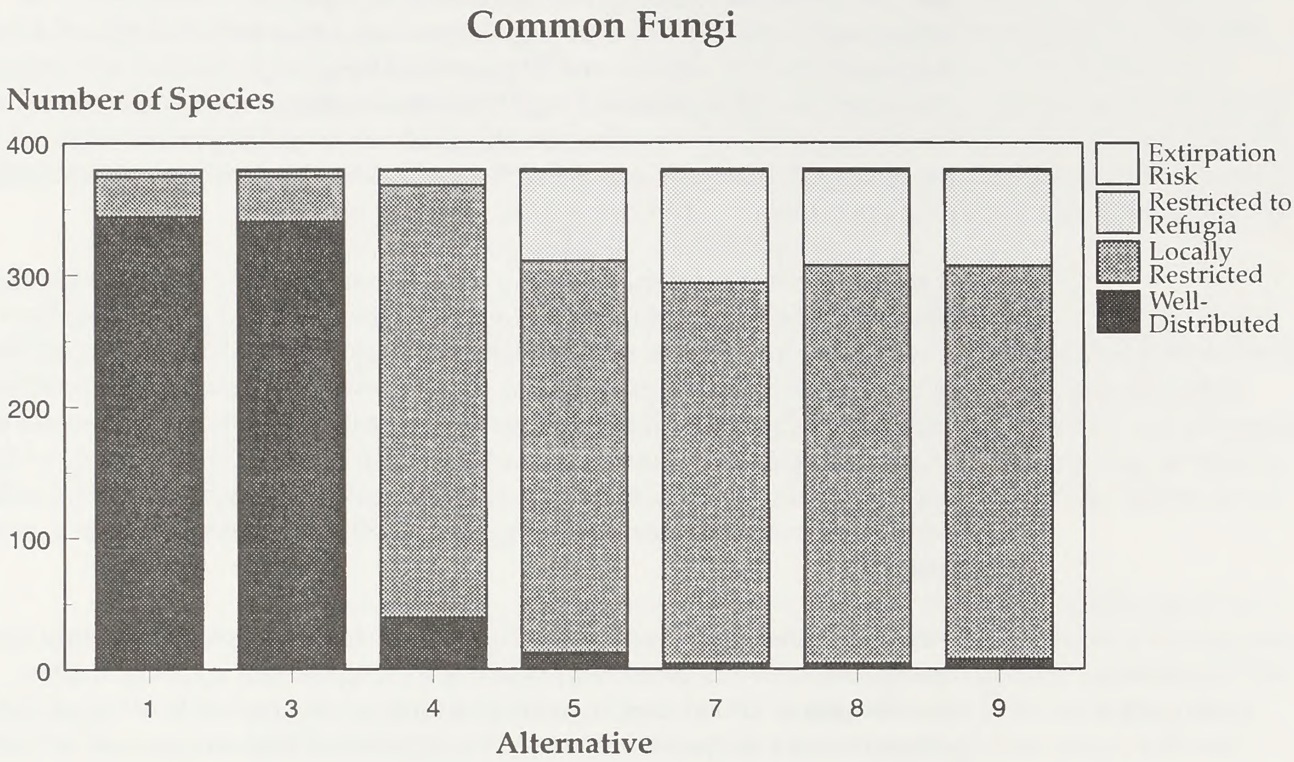
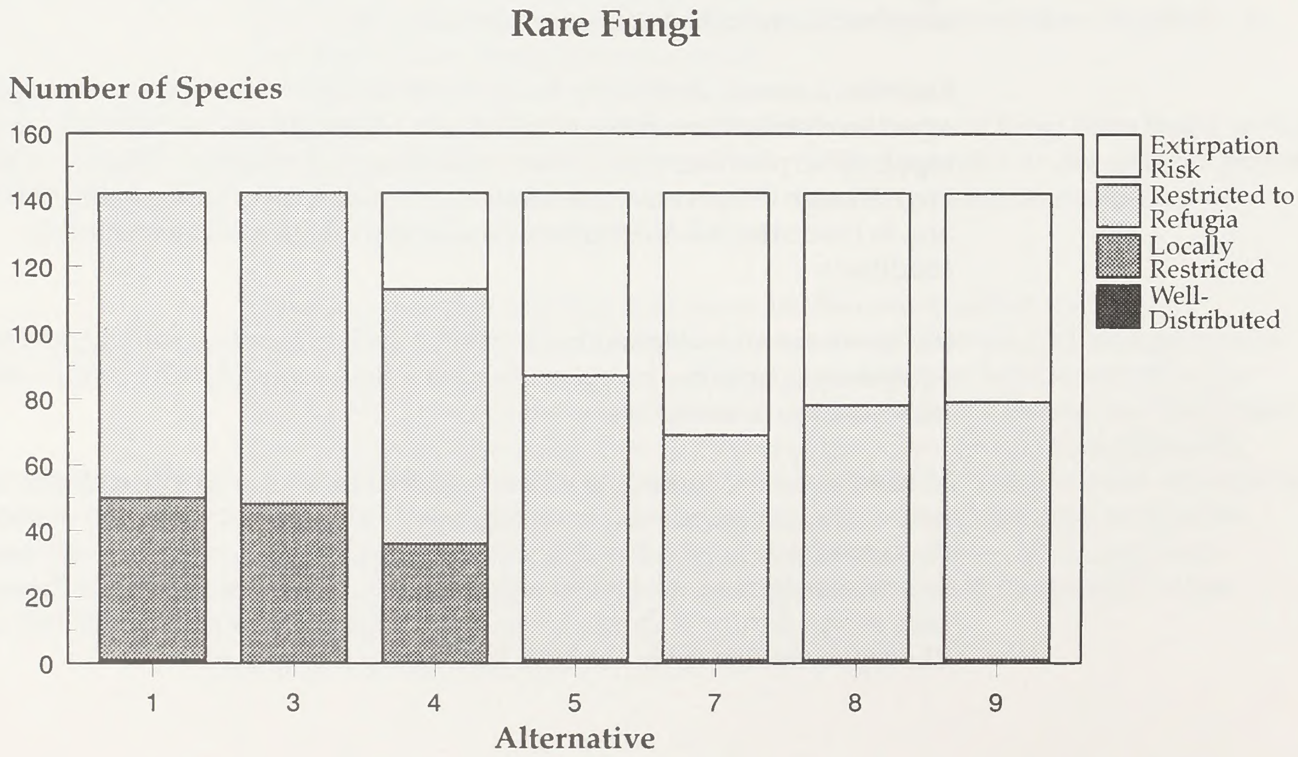


**Figure IV-5** Outcomes for rare species of fungi under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).



Inventories could be conducted, baseline data collected, and effects of harvest monitored to determine appropriate levels of sustained harvest for commercial species of fungi,. Monitoring programs suggested by Molina et al. (1993) could form the basis for determining the effects of harvest, predicting yields, and developing management practices to maintain and enhance wild mushroom harvest.

## Lichens

AFFECTED ENVIRONMENT The lichen flora in the Pacific Northwest is diverse and abundant. Lichens are a conspicuous component of old-growth forest ecosystems where they play an important ecological role. The lichen flora of the Pacific Northwest includes many endemic species, so extirpation of these species in the region equates to the extinction of the species as a whole. Twenty-six species closely associated with old-growth forests are endemic to the Pacific Northwest (Table IV-A-2, Appendix A).

Lichens perform many important ecological functions in the forests of the Pacific Northwest. They are primary producers accumulating biomass and carbohydrates, and contribute to forest nutrient cycling. Arboreal lichens capture fog and retain moisture within the forest canopy. Many lichens fix atmospheric nitrogen (Denison 1973). Their litterfall provides organic material and increases the soil moisture-holding capacity. The forage lichens are a major food source for animals such as flying squirrels, red-backed voles, and woodrats (Maser et al. 1985). They are also a food source for deer, elk and mountain goats during the winter (Hodgman and Bowyer 1985, Fox and Smith 1988). Native Americans used forage lichens for food (Turner 1990). Lichens provide habitat and food for canopy-dwelling invertebrates (Gerson and Seaward 1977), and are used by birds and small mammals for nest-building material and camouflage (Broad 1989). Air quality can be assessed by using lichens as biological indicators. Lichens are sensitive to sulfur dioxide and other gases and are efficient accumulators of heavy metals (McCune 1988). Some species of lichens show potential for antibiotic and medicinal qualities (Hawksworth and Hill 1984).

### ENVIRONMENTAL CONSEQUENCES

**Methodology Specific to Lichens** The assessment panel evaluated the outcome of 157 species of lichens that are closely associated with late-successional and old-growth forests. This is a fairly comprehensive list of the macrolichens that occur in old-growth forests in the Pacific Northwest. Seven species were not assessed because of uncertainty about their biology or distribution (Table IV-A-2, Appendix A). Lichen species were divided into 12 functional groups based on ecological relationships, and some of these were further subdivided by their degree of rarity. A discussion of the various groups is presented in Appendix A. The Assessment Team concluded that rare species that exist in refugia historically or "naturally" could not rate higher than outcome C because these species will always be distributed in isolated pockets or refugia regardless of the alternative.

**Effects of Alternatives** Outcomes for common and rare lichens are displayed in Figure IV-6, Figure IV-7, and Table IV-18 (Appendix A), respectively. Outcome ratings were generally highest for Alternatives 1, 3, then 4, intermediate under Alternatives 5 and 9 (equal), and lowest under Alternatives 7 and 8. Outcome ratings for lichens were generally correlated with the acreage of Late-Successional Reserves, stand treatments within the matrix, and protection for riparian corridors

**Figure IV-6** Outcomes for common lichens under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).

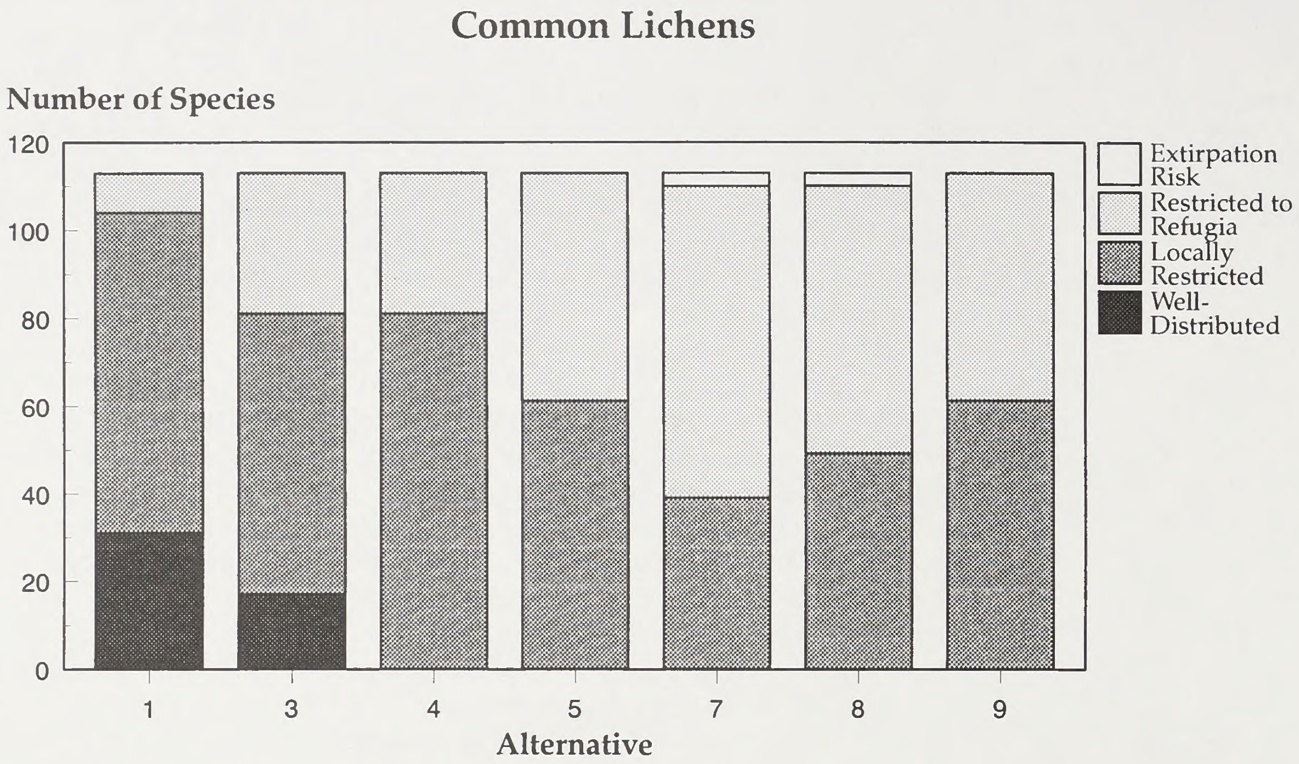
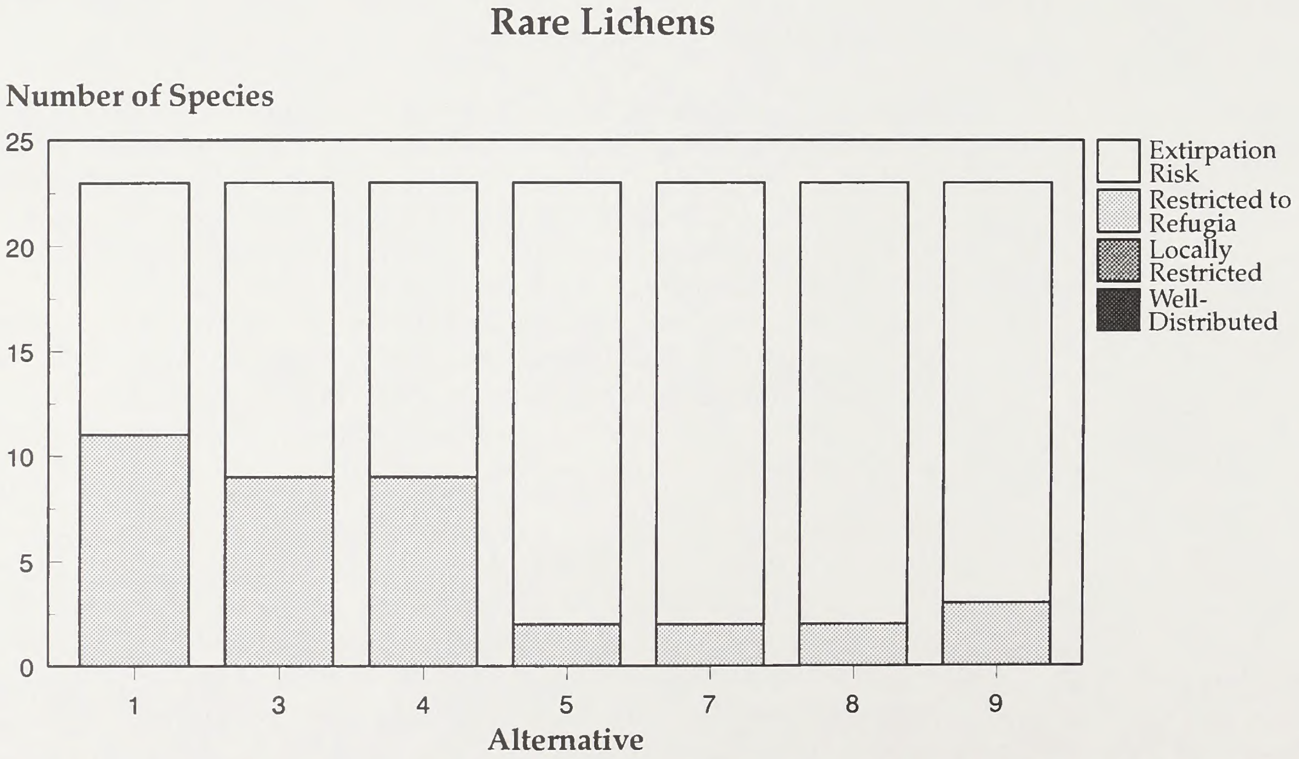


**Figure IV-7** Outcomes for rare lichens under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).



(aquatic and riparian lichens). Rare lichens rated much lower than common lichens because some of the rare lichen species have narrow geographic ranges and only occur in specialized habitats. Many of these special habitats occur as rare combinations of abiotic and biotic conditions such as a specific tree species in the fog zone of a waterfall at a low elevation.

Many lichens lack the ability to disperse and are not able to move far from the parent plant. Small patches of old-growth forest fragments distributed across the landscape are important as refugia and centers of dispersal (Esseen et al. 1992). Some lichens, particularly the nitrogen-fixing species, do not become established until stands are several hundred years old (McCune 1993). Older stands that are well distributed geographically are believed to be important to the survival and persistence of these species in the ecosystem. Riparian buffers on all orders of streams are important for the riparian and aquatic lichens.

**Functional Groups of Lichens** Outcomes for the functional groups are presented in Table IV-18, Appendix A. Under Alternative 9, there were three species groups (rare nitrogen-fixing lichens, rare oceanic-influenced lichens, and rare rock lichens) for which the 80 percent cumulative likelihood included outcome D. However, these three groups could not rate higher than outcome C under any of the alternatives due to their narrow geographic range and occupance of specialized habitats. Seven species groups (Table IV-18, Appendix A) have 80 percent cumulative likelihoods of outcome C or better under Alternative 9. Three of these groups are rare (could not be rated higher than outcome C under any alternative); two are associated with aquatic and riparian areas (which receive less protection under Alternative 9 than under Alternatives 1 and 4); and two (pin lichens and nitrogen-fixing lichens) are closely associated with late-successional and old-growth forests (which receive greater protection under Alternative 1 than 9). For further details see Appendix A.

**Possible Mitigation Measures** Because many lichen species are rare, endemic, and simply not well studied, additional surveys are needed to identify populations of rare or endemic taxa, sites of species diversity, special habitats, or unique communities. Protection of key populations from adverse management activities and designation of Botanical Special Interest Areas (BSIA) or Areas of Critical Environmental Concern (ACEC) would be important mitigation measures for these groups.

Management plans have been developed by Federal agencies for many rare animals and vascular plants; similar plans could be developed to address rare lichen species. Such plans provide biological and habitat information, management direction, and recommendations for selecting and monitoring key populations. Interagency coordination would improve the conservation and enhancement efforts for these rare species. The State Natural Heritage Programs coordinate, store, and track information on these rare species across all land ownerships.

Leave trees could be clumped within managed stands to moderate climatic factors and provide a variety of microhabitats which contribute to the survival of many lichen species. These arboreal lichen species are slow to recolonize and grow so retention clumps act as "seed trees". Therefore, it would be beneficial to maintain patches of large, old trees within the matrix rather than leaving widely spaced individual retention trees. These patches may then become the source of genetic material and propagules to disperse lichens into the adjacent stands when conditions become suitable. Big, old trees with large lateral branches provide important substrate for many species of lichens, and trees that have emergent crowns or are the largest, oldest trees in the stand should be retained. Maintaining the same leave trees over several harvest rotations is important due to the slow colonization and growth of most lichens. Additional mitigation in the matrix could include selecting for diversity in tree species and structure in the leave tree patches; leaving large down logs within the forest retention clumps will help maintain the microclimate conditions provided by the retention tree canopy.

Retention of trees on ridgelines is critical for some lichen species because this location optimizes dispersal. This pattern of retention trees mimics the retention patterns created by natural fire. Protecting rock outcrops with a buffer of trees at least one tree height in width could maintain the appropriate shade and microclimate required by lichens that grow on the rocks.

Possible mitigation for specific groups of lichens is described in Appendix A.

**The Role of Nonfederal Land**s Oceanic-influenced lichens are locally distributed and many are rare. This group could benefit from management of nonfederal lands. Directing recreational developments to minimize the degradation of botanical resources in state parks would be beneficial to these species. Surveys of coastal areas for these species and the acquisition of suitable botanical areas would also be beneficial.

Little old-growth forest remains in the coastal areas of the Pacific Northwest as a result of the fire history of the region and past harvesting activities. Stands in coastal areas could be developed into old-growth forest conditions to provide habitat for coastal species.

Much of the low elevation forest land in the Pacific Northwest is under nonfederal ownership and held by state and private timber owners. This land covers thousands of acres and is generally managed on short harvest rotations. Given that lichens are slow to establish in rapidly growing stands and do not become abundant until later in the successional development, most of these stands are harvested before lichens have a chance to establish substantial populations. Most lichen species are not able to disperse across extensive areas of young stands. Therefore, these lichen species may not be able to disperse across nonfederal lands.

### VASCULAR PLANTS

### Affected Environment

The largest and most dominant organisms of the late-successional and old-growth forest ecosystem are the vascular plants, which may tower over 250 feet, with lifespans over 1,000 years. Vascular plants are defined as those that contain conducting or vascular tissue. They include seed-bearing plants (flowering plants and conifers) and spore-bearing forms, such as ferns. They create the structure of the forest and function as the primary producers, capturing sunlight through photosynthesis and converting it to food consumed by animals and fungi. Vascular plants provide substrate and habitat for other organisms, influence microclimate (e.g., sunlight, humidity, and temperature), and provide forage, hiding, and thermal cover for vertebrate and invertebrate species. They produce litterfall that contributes to organic matter and soil development. Some species are symbiotic with fungi and other vascular plants, while others fix nitrogen. Trees with dwarf mistletoe develop broom-like structures that function as nesting platforms for birds and small mammals. Many vascular plants have close relationships with specific animal pollinators and predators.

In addition to their vital role in maintaining a functioning ecosystem, vascular plants provide commercial resources, including timber, forage, and other forest products. Harvest of medicinal, horticultural, and edible plants from Pacific Northwest forests has increased dramatically in recent years. Commercially collected vascular plant species include beargrass, salal, huckleberry, sword fern, cascara, and Pacific yew.

Within the range of the northern spotted owl, several important areas of high diversity are recognized that feature plants that are restricted to narrow geographical areas. The Oregon and California Klamath/Siskiyou and Olympic Peninsula Provinces, the Columbia River Gorge, and the Wenatchee Mountains are among the areas with highest endemism. Rare and local plants are often restricted to peculiar soils (e.g., serpentine or ultramafic) and to special habitats, such as rock outcrops, bogs, and wetlands.

Nonphotosynthetic species, such as fringed pinesap and coralroot orchid, are characterized by complex, symbiotic relationships involving both fungi and photosynthetic vascular plants (Wells 1981, Furman and Trappe 1971).

While many vascular plants colonize quickly and have short reproductive cycles, most species closely associated with late-successional and old-growth forests are long-lived perennials. Many woody and herbaceous vascular plants are extremely long-lived, requiring decades to reach reproductive size (Hanzawa and Kalisz 1993). Reestablishment in disturbed sites may be slow, particularly for species with limited dispersal. Many rare plants are characterized by low seedling production (Crowder 1978, Fredricks 1992) and are further limited by seed predation and competition from other species.

## ENVIRONMENTAL CONSEQUENCES

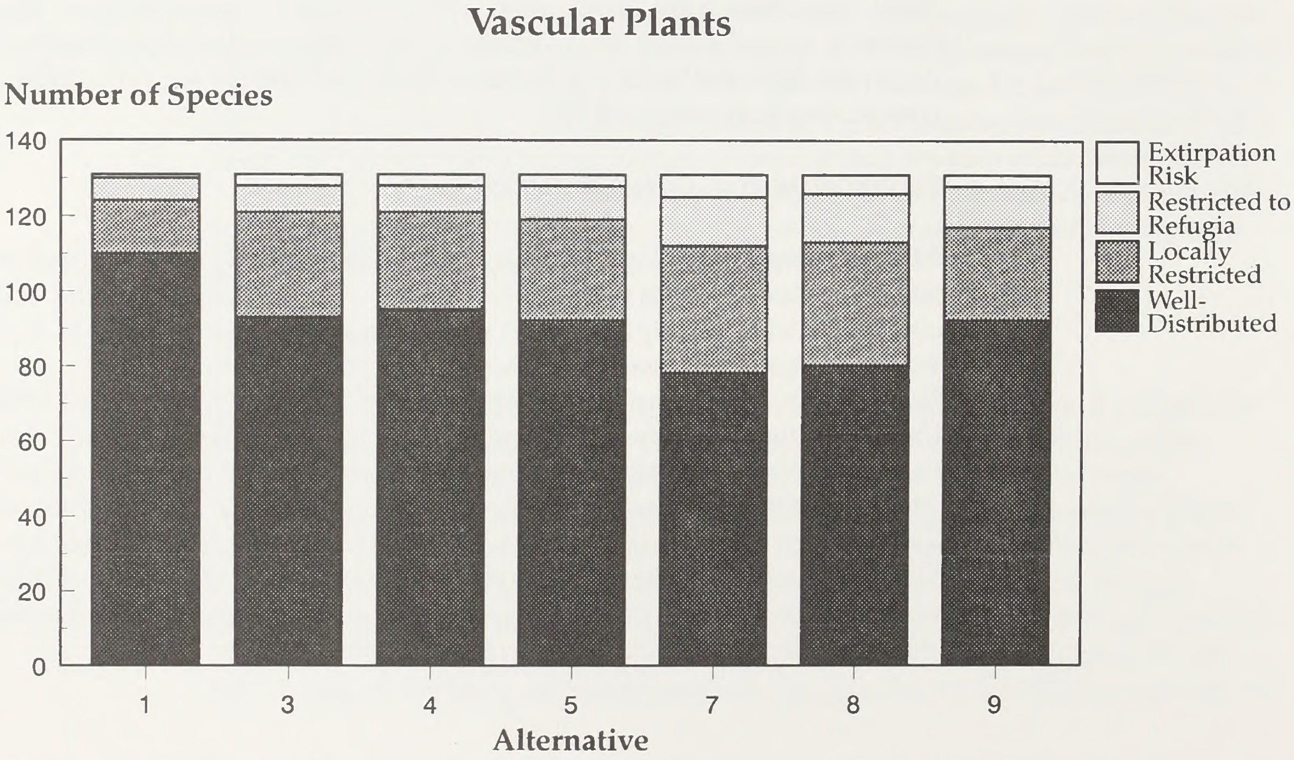
**METHODS SPECIFIC TO VASCULAR PLANTS** Hundreds of vascular plant species occur in late-successional forests in the planning area, although less than 150 species are considered to be closely associated with this seral stage (see Appendix A, Terrestrial Forest Ecosystem Assessment). The vascular plant species "short list" in the Scientific Analysis Team Report (Thomas et al. 1993) formed the basis of the list developed for this analysis. Additional input was provided by botanists from land management and cooperating agencies, universities, and from private and non-profit organizations. Twenty-five species not evaluated in the Scientific Analysis Team Report (Thomas et al. 1993) were added. Nine species considered in the Scientific Analysis Team Report were found not to meet the criteria of close association with late-successional and old-growth forests and were deleted from this analysis.

The vascular plant panel performed an assessment for 124 vascular plant taxa for each of the alternatives, based on projected future habitat conditions on Federal lands. Seven species that exhibit dissimilar ecological characteristics in different portions of their range were ranked separately based on geographical areas.

Maps illustrating the locations of populations of 19 threatened, endangered, and sensitive plants tracked by the Natural Heritage Programs were overlayed on maps of the land allocations being considered in the analysis. The species maps included both historic and current distributions. The number and percentage of known populations that occur within the various land allocations set by the alternatives were calculated and used in the viability analysis. Rare and endemic species were identified and treated separately in some analyses.

**Effects of Alternatives** Ratings for vascular plant habitat varied considerably among the alternatives (see Appendix A, Terrestrial Forest Ecosystem Assessment). A total of 110 vascular plants (84 percent) received greater than 80 percent likelihood of achieving well distributed habitat of sufficient quality, distribution, and abundance to allow populations to stabilize across Federal lands within their natural geographic range in Alternative 1. The overall ratings of Alternatives 3, 4, and 5 were similar to each other, but lower than Alternative 1 (Figure IV-9). Alternative 9 tended to have lower probabilities of achieving well distributed habitat of sufficient quality, distribution, and abundance than Alternatives 3, 4, and 5, but were higher for most species than Alternatives 7 and 8. Alternatives 7 and 8 consistently received the lowest ratings.

**Figure IV-9** Outcomes for vascular plants under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).



Ratings tended to be lowest for rare species that were geographically restricted (e.g., *Aster vialis*) or sparsely distributed throughout a larger range (e.g., *Allotropa virgata, Cypripedium fasciculatum*). Because rare species are often restricted to localized areas, the reserve areas in this analysis afforded different degrees of protection to individual species. Of the 19 species populations tracked by the State Heritage Programs, 83 percent would be protected by late-successional reserves under Alternative 1, while 53 percent would be similarly protected under Alternative 9. Many of the populations of *Poa laxiflora* (86 percent) and *Cimicifuga elata* (23 percent) occur within 50 miles of salt water. Of the populations of *Collomia mazama*, 43 percent occur within Administratively and Congressionally Reserved Areas. Key Watershed areas are important for *Botrychium montanum, Coptis trifolia, Corydalis aquae-gelidae, Frasera umpquaensis*, and *Pleuricospora fimbriolata*.

Two species were considered to have a risk of extirpation within portions of their range under Alternative 1 (*Cypripedium fasciculatum* in the Cascades province and *C. montanum* west side of Cascades), while three species were considered to have greater than 40 percent likelihood of extirpation under Alternative 7 (*Bensoniella oregana* in Calif., *Cypripedium fasciculatum* in the Cascades province, *Cypripedium montanum* west of crest of the Cascades).

In Alternative 1, 22 species had less than 80 percent likelihood of achieving well-distributed habitat of sufficient quality, distribution, and abundance. Five of these species are local endemics, three are on the periphery of their range, and thirteen are rare or uncommon. One species, *Arceuthobium tsugense*, is a parasitic epiphyte found principally on older hemlocks (*Tsuga heterophylla*), particularly in stands older than 600 years in the wetter climatic areas (Henderson pers. comm.). Substantial gaps in its historic range currently exist, and panelists predicted that the gaps would persist even under Alternative 1. Seven species were considered to have no likelihood of achieving well distributed habitat of sufficient quality, distribution, and abundance to allow populations to stabilize across Federal lands within their natural geographic range. One species (*Coptis asplenifolia*) was expected to be restricted to refugia under all alternatives.

In Alternative 7, 53 species had less than 80 percent likelihood of achieving well distributed habitat of sufficient quality, distribution, and abundance. In addition to the 22 species that received a similar outcome in Alternative 1, two commercially important conifers were included in this category for Alternative 7. Pacific yew (*Taxus brevifolia*) and Port Orford Cedar (*Chamaecyparis lawsoniana*) would have less than 80 percent likelihood of being well distributed throughout their range under Alternative 7.

Under Alternative 9, 39 species had less than 80 percent likelihood of achieving well distributed habitat of sufficient quality, distribution, and abundance. Pacific yew in the Klamath province and Port Orford Cedar throughout its range are included in this category. Others included seven mycotrophic species, three orchids, one root parasite, and five species of fern, including three grapeferns.

Historic data indicate that two species, *Cypripedium montanum* and *C. fasciculatum*, were previously more common throughout the range of the northern spotted owl. Past forest management activities have contributed to declines in their populations, and it is unlikely that most populations have retained the potential to interact. Due in part to the extremely slow growth rate, complex symbiotic relationships with other organisms, and possible fire requirements, the panel considered that recolonization of these species throughout their former range was unlikely. Both species received higher ratings in Alternative 1 than in any other alternative due to the protection of the smaller late-successional and old-growth fragments that are important to these species.

The nonphotosynthetic, mycotrophic species received lower ratings, on average, under all alternatives (except Alternative 1) compared to other species. This perhaps reflects their complex life histories involving fungal symbionts, other vascular plants, and in some cases, unidentified seed disseminators.

**POSSIBLE MITIGATION** Retention of Large Woody Debris - Some species establish only on large rotting logs, while others require specific fungi for germination and growth. These species are symbiotic species that require the close relationship between a truffle-forming fungus and a photosynthetic conifer or flowering plant, and are rarely found in stands less than 80 years old. Certain herbaceous species establish primarily on large woody debris (e.g., *Pyrola uniflora*, *Allotropa virgata*, *Listera borealis*). *Streptopus streptopoides* appears to be restricted to rotting wood substrates, leading to the suggestion that fungal interactions may be involved (Kagan and Vrilakas 1993). Large woody debris is fundamental to these species. Matrix prescriptions with larger numbers of logs, snags, and green trees may provide future habitat for these species. Large woody debris without canopy cover may be inferior to that within a closed canopy forest.

Prescribed Fire - Some species require canopy gaps that may have been maintained historically by fire (e.g., *Aster vialis*, *Cimicifuga elata*, *Frasera umpquaensis*). Fire reduces understory competition, increases light, provides a pulse of available nitrogen, and stimulates germination of some fire-adapted species. The role of fire in the life history of *Cypripedium montanum* and *C. fasciculatum* warrants further investigation; the mechanism remains unclear, but it appears fire is necessary for the persistence of these species. Underburning treatments prescribed in Alternatives 3 and 9 were considered in the evaluations. While these prescriptions may improve habitat for fire-adapted species, site-specific treatments are considered more appropriate than broader scale ones, because some species may be fire-intolerant (e.g., *Taxus brevifolia*). Specific protocols need to be developed to apply fire effectively.

Small Fragments of Late-Successional and Old-Growth Forests - Species with ephemeral seeds or limited dispersal capabilities may be particularly vulnerable to isolation. Even small fragments of late-successional forest stands may serve as genetic reserves for recolonization of adjacent habitat. Presence and distribution of small fragments of late-successional forest stands were considered important in the rating of species including *Arceuthobium tsugense*, *Adiantum jordanii*, *Allotropa virgata*, *Bensoniella oregana*, *Clintonia andrewsiana*, *Coptis trifolia*, *Corallorhiza striata*, *Cypripedium fasciculatum*, *C. montanum*, *Habenaria orbiculata*, *Hemitomes congestum*, *Hypopitys monotropa*, *Isopyrum hallii*, *Monotropa uniflora*, *Pedicularis howellii*, *Pityopus california*, *Pterospora andromedea*, and *Scoliopus bigelovei*.

Low Elevation Fragments of Late-Successional and Old-Growth Forests - At least 12 species typically occur below 3000 feet in elevation, yet low elevation old-growth forest is limited. Remaining small fragments of old-growth forest are especially important to locally endemic low elevation species, such as *Aster vialis* and *Scoliopus bigelovii*.

Special Habitats - Many species occur in special habitats, such as meadows, rock outcrops, bluffs, serpentine savannahs, marshes, and bogs, seeps and other wetlands. Opening of the canopy and disrupting the hydrology of these sites may have a negative influence on these species.

Special Reserves - Botanical special interest areas and areas of critical environmental concern could reduce risk to rare and local species by protecting habitat and key populations (e.g., *Aster vialis, Bensoniella oregana, Cimicifuga elata, Corydalis aquae-gelidae, Frasera umpquaensis, Poa laxiflora, Streptopus streptopoides*). Key habitat and populations of many of the species at risk have been already identified in conservation strategies (Cripps 1993, Gamon 1991, Goldenberg 1990, Grenier 1992, Kagan and Vrilakas 1993, Kaye and Kirkland 1993, Lang 1988).

Conservation Plans, Inventory, and Monitoring - Developing, updating, and implementing conservation strategies for species, species groups, and habitats can reduce risk for many sensitive species. Information on the distribution and life histories of many vascular plant species are needed. Few studies have attempted to track population trends of species with limited distributions and occurrences. Implementation of well-designed monitoring studies are important priorities for these species. Basic inventories and studies to determine sustainable yields of special forest products should be conducted to avoid over harvest of these resources. Riparian areas are less well studied than uplands, and development of consistent inventory and classification of riparian plant associations on an interagency basis could be initiated.

Root Rot in Port-Orford-Cedar - A pathogenic root rot (*Phytophthora lateralis*) has spread through much of the range of *Chamaecyparis lawsoniana*, resulting in the elimination of stands from some habitats and threatening the commercial status of the species throughout its range (Zobel et al. 1985). The root rot has spread from the northern portions of the species range into remote areas, killing individuals of all ages. No known genetic resistance or chemical control has been identified. The spores are spread via water and are transported primarily by people, machinery, and animals, and through root grafts (Zobel et al. 1985) (for further information see Forest Service Port-Orford-Cedar Action Plans [unpublished], Pacific Northwest and Pacific Southwest Regions, 9 p.).

**ROLE OF NONFEDERAL LANDS** Land ownership patterns may affect the persistence of at least 10 species, including a number of Coast Range inhabitants, where Federal lands are more limited in distribution. Uncertainty regarding the management of nonfederal habitat is a concern for species that have substantial portions of their range or key populations occurring off Federal lands. Many species could benefit from land exchanges and coordination among nonfederal landowners and Federal agencies.

## INVERTEBRATES

### Arthropods and Their Allies

AFFECTED ENVIRONMENT Arthropods are invertebrates with jointed legs, a segmented body, and an exoskeleton. They include insects, crustaceans, arachnids, and myriapods and collectively constitute a major source of biological diversity in late-successional forests in the Pacific Northwest. Olsen (1992) estimated that about 7,000 species of arthropods inhabit these forests and assume numerous ecological roles that are important to ecosystem function.

Arthropods inhabit virtually every part of the coniferous forest system including coarse woody debris, litter and soil layer, understory vegetation, canopy foliage, tree trunks, snags, and the aquatic system. The litter and soil of the forest floor are the site of some of the greatest biological diversity found anywhere. The soil under a square yard of forest may hold as many as 200,000 mites from a single taxonomic group, plus tens of thousands of other mites, beetles, centipedes, pseudoscorpions, springtails, and spiders. Many of these species are not described and poorly understood. The structure and function of temperate forest soils may be determined by the dietary habits of the soil arthropods (Lattin and Moldenke 1992). They are the basic consumers of the forest floor where they ingest and process massive quantities of organic litter and debris, from large logs to bits of moss (Lattin and Moldenke 1992). While the richness of arthropod species in late-successional forests suggests a great number of different processes and functions, little is known about how arthropods interact, survive, and contribute to ecosystem function.

Arthropods in late-successional forests are of concern for several reasons. First, many of the species are flightless, which means that their dispersal capabilities are limited. In fact, little is known about the dispersal capabilities of these invertebrates. Second, the flightless condition is believed to reflect habitat stability and permanence over a long period. Third, many of the old-growth forest associates have disjunct distributions and are found only in undisturbed forests. They are often found only within the range of coniferous forests within the Pacific Northwest and are therefore endemic to this area. Fourth, arthropods are key to ecosystem function and may serve as indicators of ecosystem function. They are key to nutrient cycling of down logs, are major components of the litter and soil, are herbivores of the forest canopy, play important roles in aquatic systems, and are pollinators of flowering plants. Lastly, many of the species native to this region have not been described or named, and the number of known species probably represents less than half of the number of species estimated to exist (Lattin and Moldenke 1992).

#### ENVIRONMENTAL CONSEQUENCES

**Methodology Specific to Arthropods** The Assessment Team reviewed lists of arthropods that are associated with or indicative of late-successional forests in the Pacific Northwest. These lists were contained in the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992) and the Scientific Analysis Team Report (Thomas et al. 1993). A revised list of species was assembled which includes approximately 155 insects, 25 spiders, 25 millipedes, and 1 crustacean.

of information on specific habitat associations. Second, there have not been adequate surveys of the arthropods in the Pacific Northwest. Third, the diversity of arthropods is greater than any other group of organisms (Lattin and Moldenke 1992).

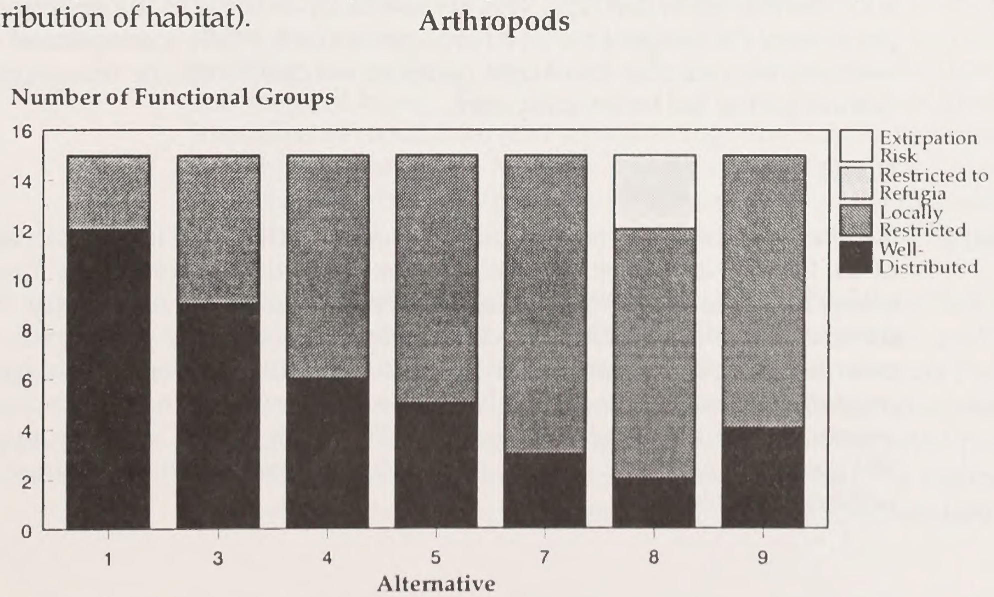
Given this complexity, the Assessment Team grouped the arthropods into 11 functional groups based on the ecological roles they occupy in the ecosystem: (1) coarse wood chewers, (2) litter and soil dwellers, (3) understory and forest gap herbivores, (4) canopy herbivores, (5) epizootic forest species, (6) aquatic herbivores, (7) aquatic detritivores, (8) aquatic predators, (9) pollinators, (10) riparian herbivores, and (11) riparian predators.

Because there is a gradient of increasing species richness and endemicity of arthropods with decreasing latitude, groups 1 through 4 were rated separately in the southern and northern portions of the range of the northern spotted owl. Thus, a total of 15 arthropod groups or ranges were assessed (11 functional groups, 4 of which received ratings for both north and south portions of their range). The southern portion consisted of the Klamath/Siskiyou Province of southern Oregon and northern California, the California Cascades, and the California Coast Range. The northern portion consisted of the eastern and western Oregon and Washington Cascades, the Oregon Coast Range, and the Olympic Peninsula.

Ratings were an expression of the likelihood that habitat to support functional groups would be maintained rather than on the viability of individual species. This approach emphasizes ecosystem function rather than a species-by-species analysis and was necessary because many of the species have not yet been identified and described. The Assessment Team expressed caution about habitat and population assessments for arthropods because of the paucity of information on this group. Therefore, the Assessment Team considered the ratings to be preliminary and subject to modification as new scientific information becomes available.

**Effects of Alternatives** The Assessment Team assessed the sufficiency of habitat on Federal lands to provide for well-distributed populations of the various functional groups. The ratings of these groups overall varied among the seven alternatives (Figure IV-14, Table IV-23, Appendix A).

**Figure IV-14** Outcomes for arthropod functional groups under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).



For most functional groups, Alternatives 1 and 3 provide the greatest likelihood that arthropod function will be maintained across Federal lands. Twelve and nine of the 15 groups or ranges, respectively, were given an 80 percent likelihood of outcome A (well distributed) under these alternatives. Alternatives 4, 5, and 9 provide for a lower likelihood with six, five, and five groups, respectively, reaching an 80 percent likelihood of outcome A. Alternatives 7 and 8 provide for only minimal likelihood that arthropod function would be maintained on Federal lands, with three and two groups, respectively, receiving an 80 percent likelihood for well-distributed populations.

More detailed discussion on the effects of the alternatives on specific functional groups is provided in Appendix A.

### POSSIBLE MITIGATION MEASURES

1. Provide coarse woody debris for coarse wood chewers and litter and soil-dwelling species.

2. Provide a full spectrum of species and sizes of trees for retention of green trees and coarse woody debris.

3. Eliminate burning as a means of site preparation after timber harvest. Burning often negatively impacts the arthropods that are associated with coarse woody debris and the litter and soil layers.

4. Retain existing small fragments of late-successional forests within the matrix. Retention of late-successional forest fragments provides important refugia for arthropods, especially canopy herbivores in lowland areas where late-successional stands are limited.

5. Limit salvage and other silvicultural manipulations within late-successional forests.

6. Provide watershed protection.

**Role of Nonfederal Lands** Most late-successional arthropod groups are likely to be maintained on Federal lands without contributions from nonfederal lands. However, the potential exists for movement of epizootic species between Federal and nonfederal ownerships. This is most likely to occur in the eastern and southern portions of the range of the northern spotted owl. While management responses will vary on a case-by-case basis, epizootic species should be recognized as a natural part of the forest ecosystem.

## MOLLUSKS

### Affected Environment

Mollusks represent a major source of biological diversity in late-successional forests of the Pacific Northwest. Mollusk species of Northwest coniferous forests are comprised of land snails, slugs, aquatic snails and clams. As a group, they are diverse in number and function and many have restricted geographic ranges and narrow ecological requirements. Scientists are still discovering new species in coniferous forests of the Pacific Northwest and estimate that the known fauna may eventually double (Frest and Johannes 1993, Roth 1993). Currently, approximately 350 species of mollusks are known to occur in forests within the range of the northern spotted owl.

Land snails and slugs account for over 150 of the 350 species of mollusks. Most are found in moist forest environments and in areas around springs, bogs, and marshes. Basalt and limestone talus slopes are also important habitats for many species. Areas within the range of the northern spotted owl possess large groups of snails that are endemic. Their distribution is influenced by geological history, soil types, moisture requirements, and vegetative cover. Over 100 species have been identified as being associated with late-successional forests.

The land snails and slugs are mostly herbivores. A few consume animal matter, and several (*Ancotrema*) feed on other snail species. Primary food items for the herbivorous species include deciduous tree leaves (both green and fallen), understory vegetation, large fungi species, and inner bark layers. Many small mammals and some birds consume land snails and slugs. Local populations of slugs or snails are often termed colonies. Densities of colonies vary from species to species, and potentially stable colonies can range in size from tens to hundreds of square feet.

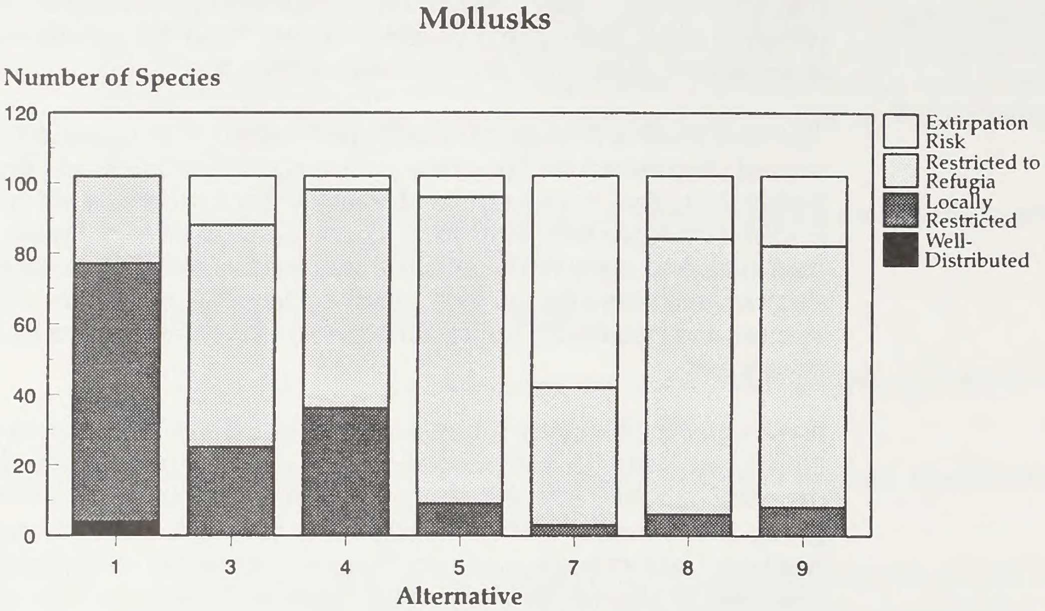
Freshwater mollusks are found in permanent water bodies of all sizes. In the Pacific Northwest, spring-fed streams and pools often support the greatest abundance and diversity of both clams and snails. There are many endemic species within the group of freshwater snails. The highest concentration of endemism occurs in northern California and southern Oregon. In this area, some species inhabit only a few seeps or springs, resulting in total species' ranges less than the size of a township. Freshwater mollusks are primary herbivores in aquatic ecosystems, and serve as food for a variety of other species including fish, aquatic insects, and birds. Some clams and snails are also eaten by raccoons, otters, and beavers.

### ENVIRONMENTAL CONSEQUENCES

**Methodology Specific to Mollusks** The list of species considered by the Assessment Team was developed by mollusk experts and was partially based on lists in the Final Draft of the Northern Spotted Owl Recovery Plan (USDI 1992) and Thomas et al. (1993) which included 58 species. The Assessment Team's list included 108 species and reflects updated information that was not available for the previous efforts. However, six of those species were not assessed because they are not known to occur on public land, or they are likely extinct. The final list of 102 species that were assessed included 38 land snails, 7 slugs, 54 freshwater snails, and 3 freshwater clams (Table IV-22, Appendix A). Most of these species are associated with both late-successional forests and riparian areas. However, the strength of these associations is not well understood in many cases, and some of the species are probably more closely associated with riparian vegetation than they are with late-successional forests. The 102 species that were assessed include eight that have been identified as candidates for Federal listing. There are seven category 2 species (*Anodonta californiensis, Monadenia fidelis minor, Monadenia setosa, Monadenia troglodytes troglodytes, Vespericola karokorum, Fluminicola columbiana, and Pisidium (C.) ultramontanum*) and one category 3 species (*Fisherola nuttalli nuttalli*).

**Effects of Alternatives** Outcomes for all the mollusks are displayed in Figure IV-13 (and also in Table IV-22, Appendix A). Only Alternative 1 provides habitat to maintain any of the mollusk species well-distributed across Federal lands with a likelihood of 80 percent or better. Assessments for Alternatives 3, 4, 5, 7, 8 and 9 indicate that a large number of species will have substantial probabilities of being restricted to refugia or extirpated. Differences among the alternatives were based primarily on the total acres proposed for reserves, the locations of specific reserves,

**Figure IV-13** Outcomes for all mollusks under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).



and the management proposed within reserves (for land snails and slugs); and on the proposed forms of watershed protection (for freshwater snails and clams). Alternatives 1 and 4 contain the full riparian protection measures proposed by Thomas et al. (1993) and analysis shows that the freshwater species would fare better under these alternatives.

High degrees of endemism and rareness account, in part, for the low ratings assigned the mollusks. Many of the mollusk species are endemic to only one region or river drainage, and dispersal capability of this group of invertebrates is low. Several of the land and freshwater mollusks in the Pacific Northwest have limited geographic ranges, and most of these species are confined to a coastal belt that extends only from the crest of the Cascade Mountains to the Pacific Ocean. There are sizeable groups of endemic species in the land snail genera *Monadenia, Trilobopsis, Megomphix*, and *Vespericola*, and the slug genus *Hemphilli*. Geologic history, substrate, moisture requirements, and vegetative cover are the physical factors that limit their distribution. Because most land snails do not disperse far from their natal sites, areas are rarely repopulated following extirpation. For freshwater mollusks, endemic species are most notable for the genera Juga, Lanx, and *Fluminicola*. Species are often confined to single streams, particularly intermittent streams, springs, and seeps. For the species that have localized geographic ranges, potential exists for serious impacts from even small ground-disturbing activities or changes in stream conditions.

**Specific Mollusk Groups** Outcomes for specific groups of mollusks including land snails, slugs, and riparian mollusks are presented in Figures IV-10, IV-11, IV-12 and in Table IV-22, Appendix A. Under Alternative 9, there were 20 mollusk species (Table IV-22, Appendix A) for which the 80 percent cumulative likelihood included outcome D. Of these, five are land snails (Ancotrema voyanum, Cryptomastix devia, Cryptomastix hendersoni, Megomphix californicus, Monadenia callipeplus);

one a slug (*Hemphilla pantherina*); and 14 are mollusks preferring riparian habitat (*Fluminicola n. sp. 2, Juga (C.) acutifilosa, Juga (C.) occata, Lyogyrus n sp. 3, Lyogyrus n. sp. 4, Lyogyrus n. sp. 5, Lyogyrus n. sp. 6, Physella columbiana, Pyrgulopsis archimedis, Pyrgulopsis n. sp. 1, Vorticifex klamathensis klamathensis, Vorticifex klamathensis sinitsini, Vorticifex n. sp. 1, Vorticifex neritoides*). In addition, 75 mollusk species (Table IV-22, Appendix A) have an 80 percent cumulative likelihood of outcome C or better. Of these, 28 are land snails; five are slugs; and 42 are associated with riparian habitat. Many of these species are locally endemic and/or rare and rate similarly under all of the alternatives. Refer to Appendix A for a detailed discussion of effects for these groups.

After reviewing the ratings for mollusks, the Assessment Team concluded that the assessments for mollusks are quite conservative. The Assessment Team believed that the alternatives, if implemented properly, would result in more favorable outcomes than perhaps indicated by these results. In addition, specific mitigation for many of the mollusk species could be relatively straightforward as discussed below.

**Possible Mitigation Measures**

1. Sites could be identified through surveys and then protected from disturbances that would cause high levels of mortality.

2. Mollusks could be included in the watershed analysis for Riparian Reserves (see Appendix B). Protocols for surveying mollusks could be developed and standardized. For best efficiency, surveys could be focused on those riparian features (i.e., springs and seeps) that are most likely to support mollusk populations. Because some mollusks and amphibians have similar habitat requirements and are associated with intermittent streams, springs, and seeps, there may be some sampling protocols that would sample both groups. When populations of mollusk species that may be at risk are found, they could be protected with buffers that are at least one site-potential tree height in diameter.

3. In addition to surveys as part of the watershed analysis process, upland sites with high potential as mollusk habitat could be surveyed prior to ground disturbance. Talus and limestone areas are two priority habitat types for survey. Surveys could be designed to address mollusks along with other species such as salamanders. In addition, some of the amphibians may serve as indicator species of areas of high endemism for mollusks (Roth 1993) because endemic forms of both taxa occur in the same area (e.g., limestone areas in the Shasta National Forest). When located, populations of mollusk species at risk could be protected with buffers that are at least one site-potential tree height in diameter.

4. Surveys and protection for mollusks could be conducted inside reserves when management activities are contemplated in the reserves.

5. Surveys could be prioritized to (1) known mollusk locations and (2) areas of high diversity or endemism.

**Role of Nonfederal Lands** Nonfederal lands are an important consideration for the persistence of some mollusks particularly in southwestern Washington and northern California. Management of slug species should be addressed on nonfederal lands in southwestern Washington. Many endemic freshwater mollusks are also associated with a mixture of Federal and nonfederal lands in northern California in the headwaters of the Shasta, Pit, and Sacramento Rivers. As more areas are surveyed for mollusks, conservation needs on Federal and nonfederal lands will become more evident.

## AMPHIBIANS AND REPTILES

### Affected Environment

The number of species of amphibians and reptiles in coniferous forests of the Pacific Northwest is not large compared to the number of birds and mammals; however, amphibians and reptiles comprise a distinct and important component of the vertebrate fauna (Bury 1988). The amphibian fauna of the Pacific Northwest includes 13 species that are endemic to the range of the northern spotted owl. The Pacific Northwest supports the second highest number of amphibian species in the United States, second only to the Southeast (Nussbaum et al. 1983). Approximately 62 species of amphibians are found in the Pacific Northwest, but fewer are found in coniferous forests. Most forested areas support as many as 19 to 23 species of amphibians and reptiles (Nussbaum et al. 1983, Stebbins 1985), and these vertebrate communities are ecologically important because of the high numbers and biomass they attain (Bury 1988). A total of 10 species of reptiles were evaluated by Thomas et al. (1993) for their association with late-successional forests, and none were found to be closely associated with this forest type. However, some reptiles, such as the sharp-tailed snake and northern alligator lizard, are associated with components of late-successional forests, including down logs and forest litter cover.

Amphibians are functionally important components of coniferous forests in the Pacific Northwest. Amphibians, particularly salamanders, can reach high densities in forest ecosystems. Aquatic larvae, terrestrial juveniles, and adults may function as predators or as the major food source for other vertebrate species and aquatic invertebrates (Walls et al. 1992).

Amphibians are particularly sensitive to environmental change because their complex life cycle exposes them to hazards in both the aquatic and terrestrial environments. Most of the species require cool, moist conditions to maintain respiratory function. Stream-dwelling species generally require cool water, and are sensitive to sedimentation that can inhibit reproduction and foraging. Within locales in the Pacific Northwest, populations of several species of amphibians have been extirpated, and the ranges of numerous species have become drastically reduced (Blaustein and Wake 1990). Most declines have occurred in forest-dwelling species. Several species including Del Norte, Larch Mountain, Siskiyou Mountains, and Shasta salamanders and western spotted, red-legged, and Cascades frogs, are candidates for listing.

Many amphibians are highly specialized; these include the predatory giant salamanders and the very primitive tailed frog. Most amphibians have specific habitat requirements such as association with headwater streams or with coarse woody debris. The clouded salamander, for example, occurs most frequently in the space between the bark and sapwood of large-diameter down logs. Twelve species of salamanders are associated with riparian areas, particularly headwater streams, springs, and seeps. Two species (Oregon slender and clouded salamanders) are closely associated with coarse woody debris. Some of the species have very restricted geographic ranges, particularly the Larch Mountain, Siskiyou Mountains, and Shasta salamanders. The special natural history traits of salamanders include low mobility and dependency on moist environments for at least part of their life cycle. The loss of moist environments following timber harvest undoubtedly influences both their local abundance and distribution. There is considerable genetic variability among and within species of amphibians as exemplified by the recent subdivision of Pacific giant salamanders into three species and the Olympic salamanders into four species within the range of the northern spotted owl (Good 1989, Good and Wake 1992). Continuing research may result in other wide-ranging species being subdivided into separate species. This high degree of variability is probably a result of their specific habitat associations and limited mobility. There is evidence of population declines and range reductions in a number of amphibian populations (Blaustein and Wake 1990, Welsh 1990). The specific habitat requirements, low mobility, high genetic variability, and restricted geographic ranges of amphibians make some of them likely candidates for Federal listing.

### ENVIRONMENTAL CONSEQUENCES

**METHODOLOGY SPECIFIC TO AMPHIBIANS AND REPTILES** The Assessment Team developed a list of species that are closely associated with late-successional forests based on the criteria of Thomas et al. (1993) who listed 28 amphibian and 10 reptilian species for initial consideration as associates with late-successional forests. Following application of a set of screening criteria to identify species closely associated with such forests, this list was reduced to 19 species of salamanders and frogs. No reptiles were retained and thus the assessment was restricted to amphibians. The Assessment Team dropped the California slender salamander from further consideration because it occurs on limited Federal acreage within the range of the northern spotted owl. Therefore, the Assessment Team evaluated a total of 18 species (17 salamanders and 1 frog). In addition, the Assessment Team subdivided one species (Van Dyke's salamander) into two portions of its total range (Washington Cascades; Washington coast, including the Olympic peninsula) and evaluated habitat conditions separately within each portion.

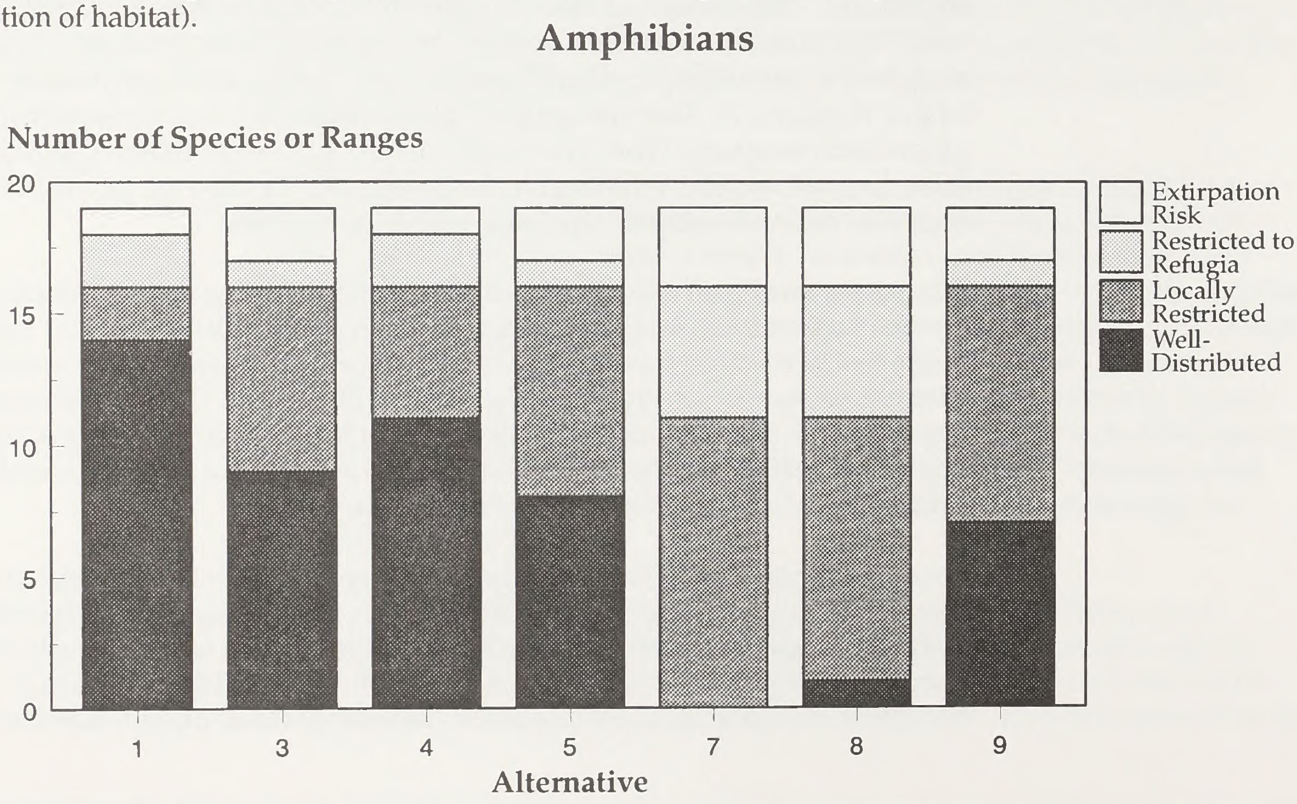
The Assessment Team recognized two general groups, those species associated with riparian habitats and those associated with terrestrial or upland habitats (Table IV-24, Appendix A). Within the riparian group, some species are found primarily in intermittent, headwater streams, including Van Dyke's and Dunn's salamanders, two species of giant salamanders, four species of torrent salamanders, and the tailed frog. Other riparian associates breed in ponds or streams but forage in terrestrial habitats (rough-skinned newt, northwestern salamander).

**EFFECTS OF ALTERNATIVES** Ratings for individual species were highly variable among alternatives (Figure IV-16; Table IV-24, Appendix A). Because of the preponderance of riparian-associated species, overall results of the analysis reflected the level of riparian buffer protection along headwater and intermittent streams in each alternative. Alternatives 1 and 4, which included the widest interim buffer widths on all intermittent streams and seeps, had the greatest number of species with high likelihoods of having well-distributed, stable populations over the next 100 years. Overall ratings for Alternatives 3, 5, and 9 were very similar, again reflecting their similar riparian standards. Alternatives 7 and 8 had much lower overall ratings. No species had a high likelihood of a stable, well-distributed population under Alternative 7 and only one species had such a likelihood under Alternative 8.

Table IV-25, Appendix A, shows that 11 of the 19 species or subpopulations occur as local endemics, restricted through habitat specialization and geographic subtleties to small, isolated populations. These small populations are at risk to local extirpation through either land management activity or catastrophic habitat modification due to natural events. Three species, the Columbia torrent salamander, Shasta salamander, and Cascades population of Van Dyke's salamander, were not rated with an 80 percent likelihood or greater for any outcome better than outcome C (restricted to refugia) for any of the alternatives (Table IV-24, Appendix A). Ratings for these species should not be considered a function of the management of Federal lands.

Total number of species that were rated into the four outcome classes varied among alternatives. Under Alternative 1, there is an 80 percent or greater likelihood that outcomes for 16 species would be B (locally restricted) or better. Of these, 14 attained outcome A (well-distributed). In contrast, Alternatives 3, 4, 5 and 9 provide habitat conditions for 16 species resulting in likelihood levels of 80 percent or more for outcome B or better, but only half of these species were most likely to achieve outcome A. For Alternatives 7 and 8, five species were rated as achieving an 80

**Figure IV-16** Outcomes for amphibians- under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).



percent cumulative likelihood of habitat conditions of only outcome C (restricted to refugia) or better and three for which the 80 percent cumulative likelihood included outcome D (extirpated).

**Possible Mitigation Measures** For the riparian-associated species, mitigation generally involves prescribing buffer widths of at least two site-potential tree heights along occupied sites. Mitigations are more variable for the terrestrial species (Table IV-25, Appendix A). Although some mitigation may be possible for the Columbia torrent salamander, Van Dyke's salamander, Siskiyou Mountains, and Shasta salamander, none could be specified to achieve an 80 percent likelihood of outcome A. These species are local endemics and cannot be successfully mitigated by measures on Federal lands alone.

Results of the assessment were based on the assumption that mitigation listed in the Scientific Analysis Team Report (Thomas et al. 1993) would be implemented for all alternatives except 7 and 8. These mitigations prescribe the designation and protection of occupied sites for Del Norte salamander, Larch Mountain salamander, Siskiyou Mountains salamander, and Shasta salamander.

**Role of Nonfederal Lands** Most species of amphibians have less than 50 percent of their range on Federal lands. This is especially true for riparian-associated species where only one species' range (tailed frog) overlaps Federal lands by more than 50 percent. Overlap of species ranges with Federal lands varies from 44 to 78 percent for terrestrial species. Only 6 percent of the range of the Columbia torrent salamander occurs on Federal land, and thus land management practices on state and private lands is of particular concern for this species. Streamside protection measures on nonfederal lands will likely continue to have a strong influence on overall population viability of riparian-associated amphibian species.

## BIRDS

### Affected Environment

The Assessment Team assessed 36 species of birds closely associated with late-successional and old-growth forests as identified in the "short list" of the Scientific Analysis Team Report (Thomas et al. 1993). The marbled murrelet and northern spotted owl were addressed in separate assessments because both were listed as threatened under the Endangered Species Act, because neither species had a final recovery plan, and because both species have been a major focus in the scientific, political, legal, and social arenas surrounding late-successional and old-growth forest management issues. The bald eagle, which is federally listed as "threatened" under the Endangered Species Act in Oregon and Washington and "endangered" in California, is included in this assessment. All alternatives incorporated the guidelines suggested in the Fish and Wildlife Service Recovery Plan for the Bald Eagle (USDI Fish and Wildlife Service 1986).

The Assessment Team's list included three species (Vaux's swift, white-headed woodpecker, and chestnut-backed chickadee) that are broadly endemic to the Pacific Northwest. Twelve of the species are cavity-nesters (pileated woodpecker, white-headed woodpecker, three-toed woodpecker, black-backed woodpecker, hairy woodpecker, red-breasted sapsucker, Williamson's sapsucker, chestnut-backed chickadee, winter wren, red-breasted nuthatch, white-breasted nuthatch, and flammulated owl), which require snags for nesting and/or forage. Optimal habitat for cavity-nesters consists of old-growth forests where the occurrence of large snags is the greatest. Additional species of waterfowl, birds of prey, and passerines are also on the Assessment Team's list.

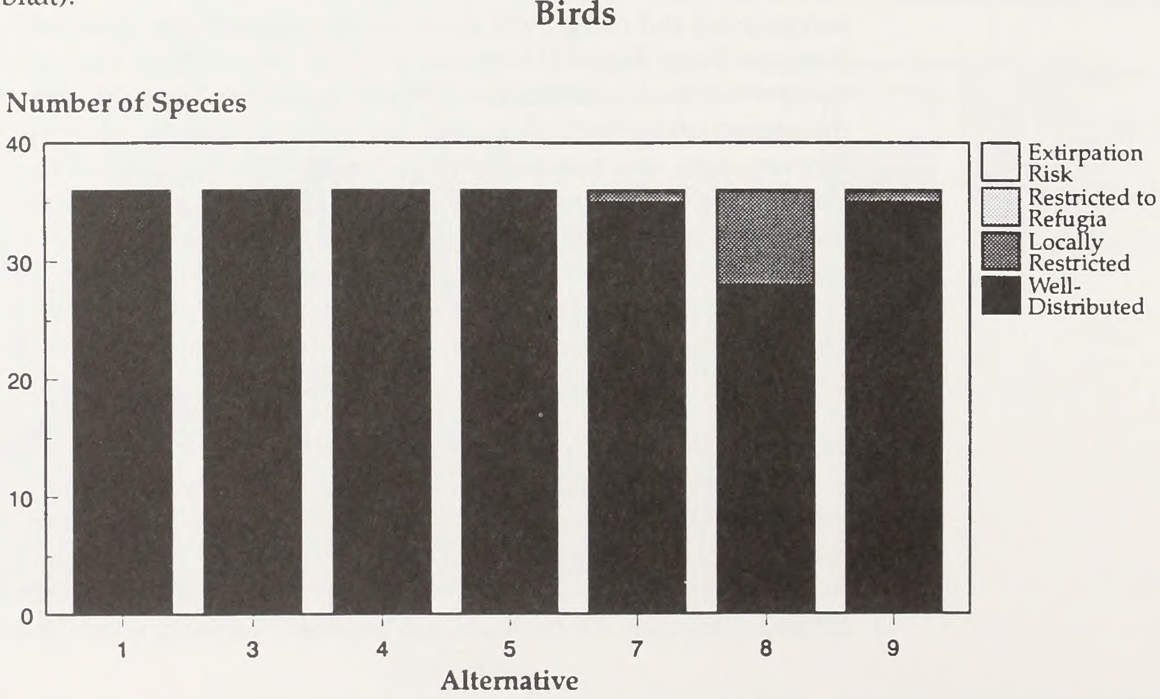
### ENVIRONMENTAL CONSEQUENCES

**METHODOLOGY SPECIFIC TO BIRDS** The Assessment Team interpreted the term "refugia" to indicate remnant populations that were not well-connected from a genetic or demographic standpoint. Outcomes A (well distributed) or B (locally restricted), on the other hand, were situations in which the populations or groups would continue to interact both genetically and demographically (albeit at different rates).

Essential considerations for bird assessment ratings were (1) provision of a system of large reserves, (2) provision of standards and guidelines for riparian protection and analysis as identified for watershed guidelines in the Scientific Analysis Team Report (Thomas et al. 1993), and (3) provisions for retention of green trees, snags, and down woody material within the matrix. When one or more of these factors was judged inadequate in an alternative, some subset of the total species usually rated lower.

**EFFECTS OF ALTERNATIVES** Some of the environmental consequences to birds were discussed previously in the Threatened, Endangered and Proposed species section. Ratings for individual species were similar among alternatives (Table IV-37, Appendix A). Alternatives 1, 3, 4, and 5 provided habitat to maintain all 36 bird species well-distributed across Federal lands with a likelihood of 80 percent or better (Figure IV-19; Table IV-37, Appendix A). For Alternatives 7 and 9, the

**Figure IV-19** Outcomes for species of birds under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).



Assessment Team concluded that 35 species had an 80 percent or greater likelihood of achieving outcome A (well distributed). For Alternative 8, seven species were rated as having less than an 80 percent likelihood of achieving outcome A, and one species (black-backed woodpecker) was rated as having less than a 60 percent likelihood of achieving outcome A.

For 19 of the 36 bird species considered by the Assessment Team, all 7 alternatives were rated as providing a 100 percent likelihood of achieving outcome A. Of those that did not rate 100 percent likelihood, most need further study to address habitat needs. In addition, the ranges of a number of species (e.g., Barrow's goldeneye, bufflehead, harlequin duck, great gray owl and flammulated owl) only slightly overlap the range of the northern spotted owl.

Alternative 7, which included rather narrow riparian buffers, rated lower for a number of waterfowl that nest adjacent to streams or lakes. Alternative 8, which allowed considerable salvage and harvest within reserves, rated lower than most other alternatives for a number of woodpeckers and other cavity nesters that depend upon large snags. Alternatives 7 and 8 also rated lower for a number of species because neither alternative included the mitigation measures that were proposed by Thomas et al. (1993) for selected species thought to be at risk under the existing Forest Plans.

Three woodpeckers (black-backed, white-headed and Williamson's woodpeckers) rated as having less than an 80 percent likelihood of achieving outcome A under one or more alternatives. All three species are primarily located in the eastern Cascades Physiographic Province.

The pygmy nuthatch was rated as having a 70 percent likelihood of achieving outcome A under Alternative 8.

The great gray owl rated as having a 73 percent likelihood of achieving outcome A under Alternative 8.

**Possible Mitigation Measures** Habitat for waterfowl that nest in forests adjacent to streams or lakes could be improved by implementing wider riparian buffers, particularly in Alternatives 7 and 8 which have reduced riparian protection.

Mitigation for the black-backed, white-headed and Williamson's woodpeckers could include adoption of more restrictive guidelines for salvage of dead trees in the eastern Cascades.

There were two species of concern for which mitigation could increase their rating in Alternatives 7 and/or 8. Impacts to the northern goshawk habitat could be mitigated by protecting occupied and key nesting and foraging habitat within the matrix as per Thomas et al. (1993) or the Forest Service Regional guidelines (whichever are more protective). Mitigation for the flammulated owl could include surveys followed by protection of nesting locations. Flammulated owls often nest in loose aggregations or "clusters" of territorial pairs. Surveys and studies of this species may provide information to better understand their distribution patterns.

Mitigation for Alternative 8 could include adoption of the Thomas et al. (1993) mitigation measures for the pygmy nuthatch.

Mitigation for the great gray owl could include adoption of the Thomas et al. (1993) mitigation measures for this species. These measures include protection of forest buffers around meadows and other forest openings within the range of the species.

ROLE OF NONFEDERAL LANDS All of the 36 birds in this assessment occur on both Federal and nonfederal lands. Some (flammulated owl, Hammond's flycatcher, hermit warbler, warbling vireo, western flycatcher, Wilson's warbler, Vaux's swift) are neotropical migrants that spend the winter in Mexico or central America. All six of the waterfowl on the list winter on lowland ponds, bays, rivers, estuaries, or surf zones where they are subject to hunting and other forms of disturbance. For all of these species, habitat on the winter range is critical for their well being. In addition, for those waterfowl that are subject to hunting, state and Federal regulatory mechanisms play a critical role in their population biology.

Because the common merganser occupies low elevation waterways often outside the influence of Federal management, its persistence could not be adequately insured by any of the alternatives considered here. The other waterfowl addressed by the Assessment Team winter in lowland areas where they are subject to hunting and other forms of disturbance. The persistence of these species is only partially a function of the quality of habitat on Federal lands.

### MAMMALS OTHER THAN BATS

#### Affected Environment

Temperate coniferous forests of the Pacific Northwest provide habitat for a diverse array of mammal species. The Assessment Team identified 15 mammal species or species complexes as being associated with late-successional forests (Table IV-A-6, Appendix A). These included forest carnivores (fisher, American marten, lynx), elk, rodents (several species of squirrels, mice, voles, and a woodrat), and insectivores (several shrews and the shrew-mole).

These mammals interact and are interrelated with the late-successional and old-growth ecosystem. The foliage- and fungi-eating mammals have important functional roles in these coniferous forests (Trappe and Maser 1976, Maser and Trappe 1984). Spores of hypogeous fungi (fungi that fruit below the ground) are primarily dispersed by small mammals in their fecal pellets. At least one study has shown that passage of spores through the digestive tracts of small mammals enhances spore germination (Cork and Kenagy 1989). Fecal pellets contain not only fungal spores, but also nitrogen-fixing bacteria and yeast which are deposited onto the forest floor. These mammals also serve an important role in physically distributing lichens throughout the forest (Rosentreter 1991).

Many of these small mammals are important prey for larger animals within the forest community. Northern flying squirrels, woodrats, red tree voles, and red-backed voles (Clethrionomys spp.) are the primary prey of northern spotted owls throughout their range (Thomas et al. 1990). Microtine voles (Microtus spp.) and red-backed voles are important prey for American martens (Strickland and Douglas 1987b). These small mammals depend on fir needles, fungi, and lichens in coniferous forests and in turn serve as food sources to predators that eat them.

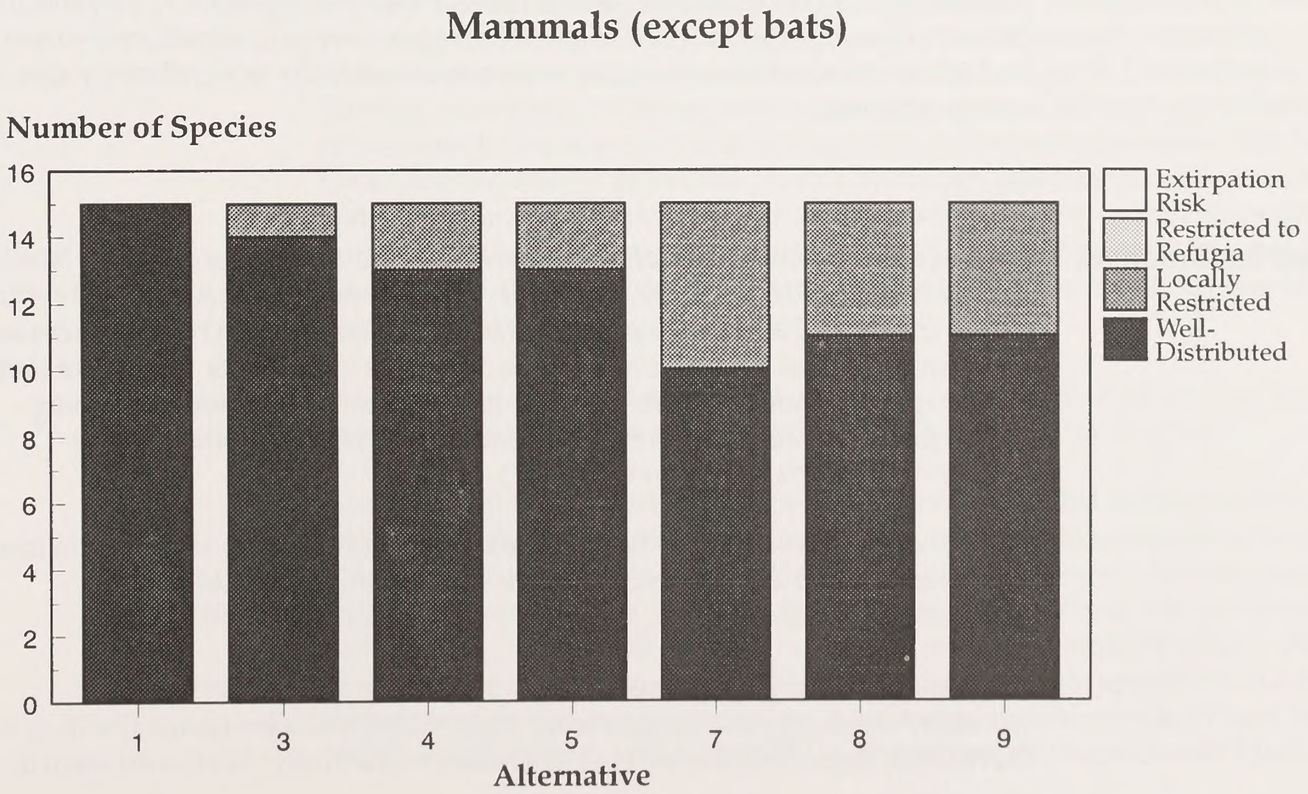
## ENVIRONMENTAL CONSEQUENCES

**METHODOLOGY** The list of species associated with late-successional forests was updated from the list originally developed by Thomas et al. 1993 and the Final Draft of the Northern Spotted Owl Recovery Plan (USDI 1992). There are some differences between the Assessment Team's list of species and those from the Scientific Analysis Team Report (Thomas et al. 1993) and the Final Draft of the Northern Spotted Owl Recovery Plan (USDI 1992c)(see Appendix A, Terrestrial Forest Ecosystem Assessment).

The lynx was included on the list of species associated with late-successional forests, but it was not rated. This species is rare, occurs within a small portion of the range of the northern spotted owl, and is not closely associated with late-successional forests for most of its life history. Much of the range of the lynx within that of the northern spotted owl occurs in Wilderness and in Late-Successional Reserves under all alternatives.

**EFFECTS OF ALTERNATIVES** The alternatives were generally rated as having above an 80 percent likelihood of providing habitat of sufficient quality, distribution, and abundance to allow the species population to stabilize, and become well distributed across Federal lands (outcome A) for all mammals except red tree voles, martens, and fishers (see Figure IV-20 and Table IV-38, Appendix A).

**Figure IV-20** Outcomes for mammal, except for bats under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).



In general, those alternatives that provided for greater amounts of late-successional and old-growth habitat resulted in higher likelihoods of producing outcome A. See Table IV-38, Appendix A, Terrestrial Forest Ecosystem Assessment for greater detail.

Alternatives 1, 3, 4, and 5 were rated as providing greater than an 80 percent likelihood of achieving outcome A for both species of red tree voles. Ratings were progressively lower for Alternatives 9, 8 and 7, respectively (Table IV-38, Appendix A), where the likelihood of outcome A was rated at 78-58 percent.

American martens were rated for the entirety of their range within the range of the northern spotted owl. They were rated as having greater than 80 percent likelihood of achieving outcome A under Option 1; Options 3 and 4 were rated 73-77 percent for outcome A. Ratings for Options 5, 8, and 9 were lower with approximately 67 percent likelihood assigned to outcome A. Option 7 rated lowest, with less than 60 percent likelihood of achieving outcome A.

Ratings for the fisher were similar to those for martens. Ratings for percent likelihood of achieving outcome A for Alternatives 1, 3, 4, 5, 7, 8 and 9 were, respectively, 85, 82, 73, 70, 67, 63, and 63 (Table IV-38, Appendix A). Ratings for fisher reflected a general uncertainty about the future welfare of this species regardless of the alternative.

All alternatives rated above a cumulative 80 percent likelihood, for all species examined, of providing at least habitat of sufficient quality, distribution, and abundance to allow the species population to stabilize, but with significant gaps in the historic species distribution (outcome B).

**POSSIBLE MITIGATION MEASURES** See the FEMAT Report (Appendix A, Terrestrial Forest Ecosystem Assessment) for specific mitigation recommendations for martens and fishers. None of these measures were considered likely to significantly alter the ratings achieved.

### BATS

#### Affected Environment

Bats are a diverse order of mammals. There may be more species of bats in North American temperate forests than any other group of mammals. All forest-dwelling bats in the Pacific Northwest are insectivores. Bats that forage in riparian areas and fly to upland forests to roost may serve as dispersers of nutrients. Because of their large population numbers, bats may play an important role in nutrient cycling within forests (Christy and West 1993). Bats also serve an important role as predators of insects (Whitaker et al. 1977).

Population declines that have been documented worldwide are attributed to loss of habitat and disturbance of maternity colonies and hibernacula (Mohr 1948, Edgerton et al. 1966, Cockrum 1969, Tuttle 1979, McCracken 1988).

Large snags and large green trees are important because bats use them for maternity roosts, day roosts, temporary night roosts, and hibernacula (Barbour and Davis 1969, Kunz 1982, Rainey et al. 1992). Bats in the Pacific Northwest seem to prefer old forests, presumably due to more potential roost sites under bark, in crevices, or in hollows of large, old trees (Perkins and Cross 1988, Thomas and West 1991). Suitable roost sites require access to water (for drinking and foraging), protection from predators, and favorable temperature and moisture regimes (Christy and West 1993). Temperature regimes are important to bats (van Zyll de Jong 1985, Fenton and Barclay 1980), and thermal stability may be influenced by structural characteristics within large snags or trees. The hoary bat is the only foliage-roosting bat (Constantine 1966, Barclay 1985) on the list of species closely associated with late-successional forests. Hoary bats are not very maneuverable during flight and need tall trees with foliage high from the ground so they can drop to gain momentum for flight.

### ENVIRONMENTAL CONSEQUENCES

**METHODOLOGY** The list of species closely associated with late-successional forests was originally derived from Thomas et al. (1993) and the Final Draft of the Northern Spotted Owl Recovery Plan (USDI 1992c). As a result of additional review, there are some differences between the Assessment Team's list of species and these previous efforts.

The Assessment Team identified eleven species of bats associated with late-successional forests, including seven species of Myotis, the big brown, pallid, silver-haired, and hoary bats (Table IV-A-6, Appendix A).

In evaluating the effects of the alternatives on bats, a number of factors were considered. Large acreages of Late-Successional Reserves well distributed across the landscape were considered critical for bats because of the importance of large green trees and snags for roosting sites. Late-Successional Reserves will be an increasingly important source of large trees and snags. The proposed management for the matrix was also a critical factor in the ratings, primarily due to concerns regarding adequate density of snags. Alternatives containing the Aquatic Conservation Strategy watershed guidelines were consistently rated as having higher likelihood of outcome A than alternatives containing lesser watershed guidelines. The Aquatic Conservation Strategy guidelines provide protection of intermittent streams, key watersheds, and small lakes and ponds (less than 1 acre) with a full tree height buffer (described in greater detail in Appendix A, Terrestrial Forest Ecosystem Assessment). This is because of the potential bat habitat that would be provided by the additional trees within the buffer.

For additional detail, see the general discussion of panel assumptions and the process for evaluating and describing the results earlier in this chapter.

**EFFECTS OF THE ALTERNATIVES** The different alternatives varied in their likelihoods of providing sufficient and well-distributed habitat on Federal lands (outcome A) to ensure persistence of bats (Figure IV-21; Table IV-39, Appendix A). Alternatives 1 and 3 were rated highest, and Alternatives 7 and 8 rated lowest. All species rated more than 80 percent likelihood for outcome A under Alternatives 1 and 3 (Figure IV-21 and Table IV-39, Appendix A). For Alternative 4, eight species rated more than 80 percent likelihood for outcome A (all except Keen's myotis, fringed myotis, and silver-haired bats, which rated 75, 77, and 78 percent, respectively). Under

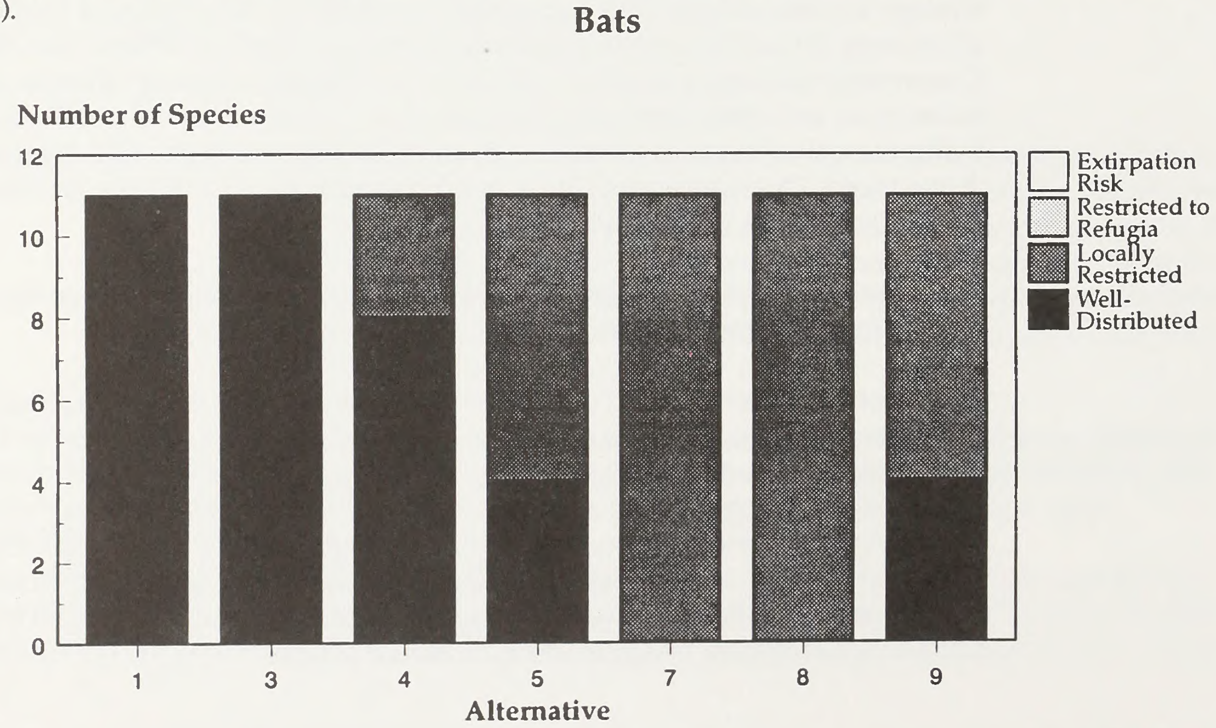
Alternative 5, four species rated more than 80 percent likelihood for outcome A, and seven species rated 65-73 percent (fringed myotis, Keen's myotis, long-eared myotis, long-legged myotis, pallid bat, silver-haired bat, and hoary bat). For Alternative 9, four species rated more than 80 percent for outcome A, two species rated 60-70 percent (long-eared myotis, and pallid bat), and five species rated 45-55 percent (fringed myotis, Keen's myotis, long-legged myotis, silver-haired bat, and hoary bat). No species rated more than 80 percent for outcome A under Alternatives 7 or 8, and seven species rated less than 60 percent under each of these options.

See Appendix A, Terrestrial Forest Ecosystem Assessment, for a more detailed discussion of effects of alternatives.

**Possible Mitigation Measures** Bat colonies in mines and caves could be identified and protected under all alternatives. Site-specific analyses could be done to determine species using the structure, approximate size of the colony, and whether it is a hibernacula, maternity, or bachelor colony. Harvest prescriptions and layout near mines and caves that are used by bats could be modified to prevent impacts to bat colonies. Cave entrances could be gated in such a way that air flow patterns are maintained (Tuttle 1977), people are excluded, and bats can freely enter and exit. If these mitigation measures were implemented and enforced, ratings for the group of bats that roost in both trees and other structures could be raised.

**Role of Nonfederal Lands** Keen's myotis is found exclusively in the Pacific Northwest and occupies a restricted range within western Washington, western British Columbia, and southeastern Alaska. In Washington, it is found primarily on nonfederal lands. This species most likely has a strong association with late-successional forests: it was included in the group of Myotis species that were judged to be associated with old-growth forests by Thomas and West (1991). Forested habitat within the range of this species has declined substantially due to urbanization in lowland areas around Puget Sound.

**Figure IV-21** Outcomes for bats under each land management option. Values shown are the number of species that had an 80 percent or greater likelihood of achieving at least the specified outcome (based on distribution of habitat).



## AQUATIC SPECIES

### Affected Environment

Populations of anadromous salmonids become reproductively isolated from each other as they ascend their spawning streams. These locally adapted populatons are referred to as stocks. More than 100 unique stocks are already extinct. The Endangered Species Committee of the American Fisheries Society recently identified 214 stocks in California, Idaho, Oregon and Washington as in need of special management considerations because of low or declining numbers. Additional reports have been released on the status of West Coast anadromous salmonid stocks that provide more detailed stock assessments and in some cases subdivide many of the stocks listed by the American Fisheries Society. Within the range of the northern spotted owl there are an estimated 314 anadromous stocks at risk.

Primary factors contributing to the decline of anadromous salmonid stocks include: (1) degradation and loss of freshwater and estuarine habitats; (2) timing and over-exploitation in commercial and recreational fisheries; (3) migratory impediments such as dams; and (4) loss of genetic integrity due to the effects of hatchery practices and introduction of non-local stocks. Often two or more of these factors operating in concert are responsible for a decline in population numbers.

Some resident fish populations have exhibited declines similar to those of anadromous salmonid stocks. Habitat loss and degradation are principal causal factors in declines of these fishes. In addition, introductions of nonnative fish and artificial propagation practices have impacted resident trout populations. Like anadromous salmonid stocks, many of these fishes have been adversely affected by hatchery practices or overharvest.

### ENVIRONMENTAL CONSEQUENCES

**METHODOLOGY** In assessing the alternatives, the Assessment Team Group considered five factors: (1) assessments of habitat conditions for the individual races/species/groups made by the assessment panel; (2) amount of Riparian Reserves and type and level of land-management activity allowed within them; (3) extent of other reserves (e.g., Congressionally designated withdrawls, Late-Successional Reserves, etc.), and type and level of land management allowed within them; (4) presence of a watershed restoration program; and (5) prescriptions for managment of the matrix.

The Assessment Team considered the first three factors equally in determining the score for an outcome under each alternative. It believed that these components most strongly influence the preservation, maintenance, and restoration of aquatic ecosystems and habitat.

The assessment panel assessed the likelihood of attaining a set of outcomes for habitat of individual races/species/groups of fish on Federal lands for each alternative. This outcome-based scale was developed to express the range of possible trends and future habitat conditions on Federal land (Appendix A, Aquatic Ecosystem Assessment).

The panel compared alternatives by assessing the likelihood of each to achieve outcome A. However, there is no single such level that represents a viable ecosystem or habitat, or a viable population for all species and circumstances. The level was chosen here as a point of comparison only; other levels - for example, a 95 percent likelihood of achieving outcome A, or a 60 percent likelihood of outcome B - could also be chosen for comparing alternatives. The information on likelihoods is available and amenable for such additional comparisons.

In making their assessments, the assessment panel was told to assume that the Aquatic Conservation Strategy would be fully implemented. This included the protection of the Riparian Reserves, establishment of Key Watersheds, implementation of Watershed Analysis, and a comprehensive program of watershed Restoration. The term Scenarios was used to describe the widths of the Riparian Reserves. Scenario 1 has a Riparian Reserve width of one mature tree height on all intermittent streams. Scenario 2 retains a Riparian Reserve width of one-half a mature tree height in non-Key Watersheds. Scenario 3 retains a Riparian Reserve width of one-sixth a mature tree height on all intermittent streams, and also provides less protection on non-fish bearing perennial streams.

The panel assessed the likelihood of attaining the set of outcomes for the individual races/species/groups of fish for each alternative. The panel was presented with descriptions of the outcomes and alternatives. They were also asked to partition out the effects of factors such as habitat conditions on nonfederal land, land ownership patterns, and oceanic conditions. Each panelist made his or her own assessment. Like the Terrestrial Ecosystem Assessment, the assessment panel was only ask to assess Alternatives 1, 3, 4, 5, 7, 8, and 9. The Assessment Team then used this information as part of its assessment of the alternatives. The assessment panel was not asked to consider Alternatives 2, 6 and 10. Assessment of these alternatives was done by the Assessment Team.

In the assessments, it was assumed that the boundaries of Riparian Reserves, particularly in intermittent streams, would change following watershed analysis. This does not imply, however, that watershed analysis may always reduce the boundaries of Riparian Reserves in intermittent streams; it is expected that actual boundaries will vary considerably among watersheds. It was assumed that the boundaries in other stream types would not vary appreciably. In all cases the Assessment Team assumed final Riparian Reserves would provide the necessary range of ecological functions and processes that create and maintain good fish habitat.

The Assessment Team believes that Reserves such as Congressionally Withdrawn Areas and Late-Successional Reserves construed two benefits to aquatic habitat and ecosystems. These are areas where land-management activity would be limited. They would thus provide a high level of protection for all streams within them. This would in turn provide the ecological functions and processes necessary for the creation and maintenance of fish habitat. Additionally, streams in Reserves could serve as cores of good habitat in a landscape with large areas of poor habitat. They would be refugia and population centers for recolonization as degraded areas recovered in the future. This would be particularly important for locally distributed fish species and races. The greater the amount of these reserves the greater would be the level of protection for existing aquatic ecosystems and habitat.

The other factors, watershed restoration and matrix management prescriptions, were given less weight. However, the Assessment Team and the assessment panel acknowledged that a comprehensive watershed restoration program was needed for restoring aquatic habitat, particularly in the short term. Among alternatives, matrix management prescriptions were weighted according to the area of the matrix and required management guidelines (e.g., rotation length, green tree retention). The greater the green tree retention requirements, and/or the longer the rotation, the greater the contribution to the likelihood rating.

The assessment panel was presented with 19 races/species/groups of fish to consider. A total of 29 species were contained in these groupings (Table V-10). Of these species, five were then being considered for status under the Endangered Species Act, and one other was identified in the professional literature as in need of special management consideration because of low or declining populations.

Members of the assessment panel decided to fully evaluate only seven of the 19 races/species/groups presented originally. Reasons for not considering the 12 races/species/groups were: (1) insufficient information on the ecology to make a valid assessment; (2) limited distribution of the species/group/races on Federal lands within the range of the northern spotted owl; and (3) judging from available information possible habitat alterations that may occur as a result of land-management practices on Federal lands would have no or negligible effect on the habitat of the species/group/race. The panel commented on what they believed may be the potential outcome of an alternative on some races/species/groups for which they had limited knowledge. The Assessment Team evaluated only the seven races/species/groups fully considered by the assessment panel.

All fish in the species/groups for which assessments were made are salmonids. Most are distributed in streams of late-successional forests on Federal lands throughout the range of the northern spotted owl. They use a wide size range of streams, from larger streams by chinook salmon to small, headwater streams by resident cutthroat and rainbow trout. All require clean gravel to reproduce successfully, cool water, and diverse and complex habitat. As discussed previously, habitat features for these fish are susceptible to impacts from land management practices and so these fish are reasonable indicators of ecosystem health.

**Effects of Alternatives** The assessments of the alternatives are displayed in Appendix A, Aquatic Ecosystem Assessment. Alternatives 1 and 4 had the highest likelihood of attaining outcome A (i.e., habitat will be widely distributed on Federal lands throughout the range of the northern spotted owl); the likelihood was 80 percent or higher for all race/species/groups (Figure V-24). The relatively high likelihood for these alternatives was because of the large amount of area in reserves and the Riparian Reserve 1 strategy on all Federal lands within the range of the northern spotted owl.

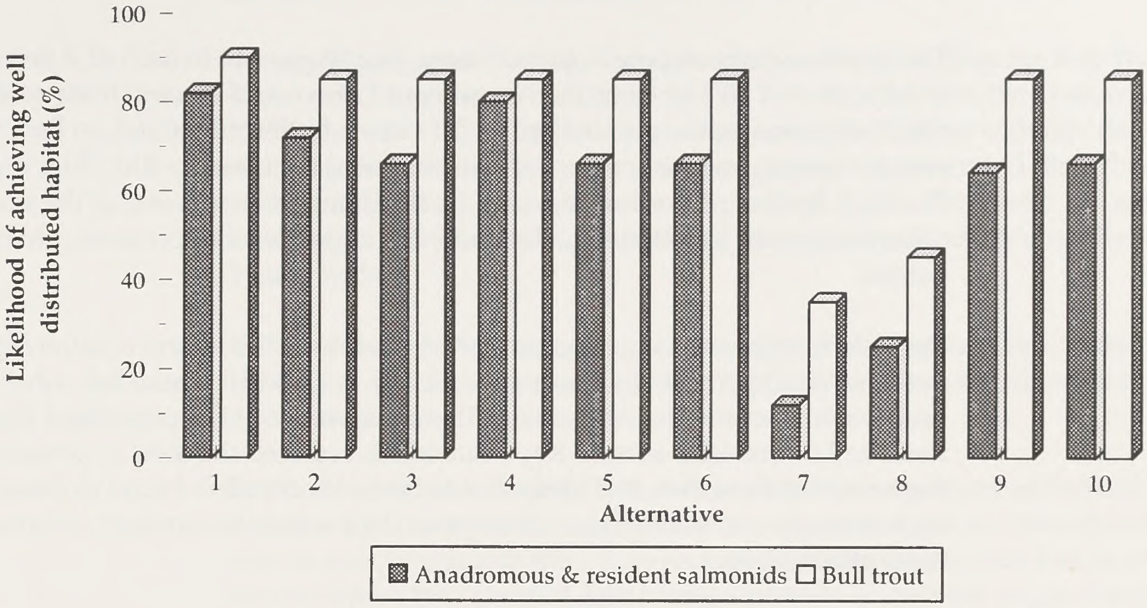
The higher likelihood of attaining outcome A for aquatic habitat on Federal land

**Table V-10.** Fish races/species/groups presented to but not considered by expert panel.

| | Reason not considered | | |
|---|---|---|---|
| Fish Species | Insufficient information on ecology | Limited distribution on federal lands | Possible effects from land management practices on federal lands negligible |
| Pacific lamprey | X | | |
| Sockeye salmon[1] | | X | |
| Pink salmon[1] | | X | |
| Chum salmon[1] | | X | |
| Redband trout | | | |
| White River, OR | X | | |
| McCloud River, CA[2] | X | | |
| Jenny Creek, OR | X | | |
| Mountain whitefish | X | | |
| Dolly varden | | X | |
| Umpqua squawfish | | X | X |
| Umpqua chub | X | X | |
| Oregon chub[2] | X | X | |
| Olympic mudminnow[2] | X | | |
| Salish sucker[3] | X | | |
| Jenny Creek sucker[2] | X | | |
| Reticulate sculpin | X | | |
| Paiute sculpin | X | | |
| Riffle sculpin | X | | |
| Shorthead sculpin | X | | |
| Torrent sculpin | X | | |
| Mottled sculpin | X | | |
| Coastrange sculpin | X | | |
| Longnose dace | X | | |
| Millicoma dace | X | | |

[1] Some stocks within region of the northern spotted owl listed by Nehlsen et al. (1991) as in need of special management considerations because of low or declining populations.
[2] Candidate for listing under Federal Endangered Species Act.
[3] Listed by Williams et al. (1991) as in need of special management considerations because of low or declining populations.

**Figure V-24.** Assessment outcomes for anadromous and resident salmonids and bull trout for each Alternative. Alternatives 2, 6, and 10 are internal assessments not rated by expert panels.



The higher likelihood of attaining outcome A for aquatic habitat on Federal land under alternatives 1 and 4 stems from combining lower timber harvest levels with wider interim Riparian Reserve widths on non-Key Watershed intermittent streams than under any other options. For example, Alternative 9 received a 65 percent likelihood of attaining outcome A for fish habitat while Alternatives 1 and 4 received greater than 80 percent likelihood of achieving outcome A. Alternative 9 designated 2.2 times more acres in the matrix than Alternative 1 and 1.6 times more than Alternative 4. Under Alternative 9, 22 percent of the remaining late-succession forest is in the matrix compared to zero percent in Alternative 1. In addition, Riparian Reserve 2 scenario is applied rather than the Riparian Reserve scenario 1 used in Alternatives 1 and 4.

The primary difference between Riparian Reserve 1 and 2 scenarios is the interim width required for Riparian Reserves on intermittent streams in non-Key Watersheds. Interim Riparian Reserves for these streams in non-Key Watersheds are delineated using one site-potential tree height in Riparian Reserve 1 and one-half a site potential tree height in Riparian Reserve 2. In non-Key Waterhseds, land-management activities can proceed outside Riparian Reserves before conducting a watershed analysis, thus the risk to aquatic and riparian habitat is, in part, determined by the interim width of these reserves.

Alternatives 2, 3, 5, 6, 9, and 10 generally had a 60 to 70 percent likelihood of attaining outcome A for all races/species/groups. These alternatives had a smaller likelihood of attaining outcome A than Alternatives 1 and 4 because of a combination of less area in Reserves and the Riparian Reserve 2 scenario, which has Interim Riparian Reserves of one-half of a site potential tree in intermittent streams outside Key Watersheds.

The likelihood of outcome A for bull trout was 85 percent in each of Alternatives 2, 3, 4, 5, 6, 9, and 10. As far as the Assessment Team could discern from available distribution maps, the vast majority of, if not all, bull trout habitat on Federal land within the range of the northern spotted owl was contained within Key Watersheds. The high level of protection provided by the Riparian Reserves and the extent of other reserves in Key Watersheds resulted in a high level of protection to bull trout habitat.

Resident rainbow and cutthroat trout had the lowest likelihood of attaining outcome A, 60 percent, for Alternatives 2, 3, 5, 6, 9 and 10. These fish inhabit small, headwater streams. The Assessment Team believed that the prescribed Riparian Reserve 2 boundaries outside Key Watersheds reduced the level of protection for the habitat of these fish. It is likely that habitats of other fish found in these streams such as many of the sculpins and longnose dace would be similarly affected by these alternatives.

Alternatives 7 and 8 had the lowest likelihoods of attaining outcome A for all races/species/groups. The likelihood of attaining outcome A for Alternative 7 was from 10-15 percent, the exception being bull trout, which was 35 percent. Alternative 7 was ranked low primarily because of the low amount of riparian areas and the amount of activity that was allowed within them in BLM land management plans and in many Forest Service forest plans. It should be noted that these assessments reflect assessments for forest plans as a group and not for individual plans, which varied tremendously. During the life of the plan, many individual plans stated that fish habitat would continue to degrade due to management activities, other plans provide non-degraded conditions as well as watershed restoration.

Likelihoods of attaining outcome A were slightly higher for Alternative 8 than for Alternative 7 but were less than for the other alternatives. Likelihoods of attaining outcome A ranged from 20-25 percent for all groups except bull trout, which was 45 percent, in Alternative 8. Alternative 8 has a lower likelihood of attaining outcome A than did alternatives other than 7 because of the reduced size of Riparian Reserves, particularly for intermittent streams. However, the Assessment Team thinks all Alternatives except 7 and 8 will reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on Federal lands within the range of the northern spotted owl.

**POSSIBLE MITIGATION MEASURES** If it is desired to increase the likelihood of achieving outcome A for fish habitat of all races/species/groups to 80 percent or greater for Alternatives 2, 3, 5, 6, 9, and 10, the Assessment Team recommends two possible strategies. One strategy is to replace the Riparian Reserve 2 scenario used in these options with the Riparian Reserve 1 scenario. Application of Riparian Reserve 1 scenario provides greater protection for fish habitat in non-Key Watersheds.

Major beneficiaries of such an action would be coastal area National Forests (Six Rivers, Siskiyou, Siuslaw, and Olympic National Forests) and Bureau of Land Management Districts (Salem, Eugene, and Coos Bay Districts). These coastal areas have a large number of at-risk anadromous salmonid stocks, large areas of unstable land, and a relatively small proportion of the total area in Key Watersheds compared to more inland areas.

A second mitigation strategy is to provide greater protection for Key Watersheds. This could be achieved by removing Key Watersheds from the areas available for timber harvest. Thus, land management activities in these watersheds would be reduced, diminishing the potential for management generated disturbance. This additional protection would be most beneficial in the short-term because the relatively small amount of good habitat that remains is predominantly found in Key Watersheds.

Either of these mitigation strategies would probably be sufficient to increase the likelihood of achieving outcome A for fish habitat above 80 percent for all alternatives except 7.

ROLE OF NONFEDERAL LANDS This habitat viability assessment of Federal habitat does not directly correspond to population viability of the species considered. This is due, in part, to impacts from non-Federal activities and to activities in other habitat sectors where the species might spend a portion of their life cycles. Furthermore, with anadromous fish, there is a very limited science availabile to establish direct relationships between land-management actions and population viability due, in part, to other impacts such as predation and artificial propagation and the difficult of translating these impacts into population numbers.

In considering the effects of any Federal land management alternative on aquatic resources, two key points are important: 1) there are potentially other factors such as overutilization, disease, artificial propagation practices and other habitat impacts such as hydropower and irrigation developments that have degraded and continue to degrade aquatic habitat; and 2) a plan for managing Federal lands will not solve problems caused on nonfederal land, and aquatic resources, for example anadromous salmonids, are adversely impacted by nonfederal actions.

## SPECIES ASSOCIATED WITH EARLY-SUCCESSIONAL FORESTS

### Affected Environment

A variety of fish, wildlife, plant and invertebrate species within the range of the northern spotted owl use early-successional forests as primary habitat for breeding and/or feeding.

### ENVIRONMENTAL CONSEQUENCES

Alternative 7 provides the greatest amount of habitat in the youngest successional stages because of the higher level of timber harvest that would occur. Alternatives 8, 9, 5, 4, 3 and 1 would provide decreasing amounts of this habitat, respectively. Alternatives that provide for the greatest amount of habitat in the youngest successional stages would generally result in the best outcomes for early-successional associated species. In general, those alternatives that provide for higher levels of timber harvest will produce greater amounts of this habitat.

Under all alternatives except Alternative 1, some existing late-successional forest will be harvested, creating early-successional habitat. In addition, there is currently additional acreage of early-successional forest intermixed in a fragmented pattern with late-successional forest on Federal lands across the range of the northern spotted owl. Timber harvest over the past 40 years has resulted in more of this habitat than was historically present as a result of natural processes such as wildfire. Species using early-successional forests and edge habitats benefit more from alternatives that provide fewer and smaller designated areas.

The matrix areas of Federal forest lands as well as nonfederal forest lands are likely to be maintained in various levels of early-successional forests. The extent of these lands throughout the region should assure adequate habitat for species which depend on early-successional forests.

## Three Court-Identified Defects to the Forest Service 1992 FEIS

### INTRODUCTION

On May 28, 1992, the U.S. District Court for Western District of Washington found the January 1992 *Final Environmental Impact Statement on Management for the Northern Spotted Owl in National Forests* (FEIS) defective in three areas (*Seattle Audubon Society, et al.* v. *Moseley et al.*, No. C92-479WD (*SAS* v. *Moseley*)). On July 2, 1992, the Court enjoined the Forest Service from auctioning or awarding any additional timber sales that would log suitable habitat for the northern spotted owl, and ordered the preparation of a new or Supplement Environmental Impact Statement, and a new Record of Decision.

The three defects to be corrected are summarized as follows:

**Thirteen Bureau of Land Management Timber Sales.** The May 14, 1992, exemption by the Endangered Species Committee of 13 Bureau of Land Management timber sales from the requirements of the Endangered Species Act requires reevaluation of the selected alternative, the Interagency Scientific Committee (ISC) Conservation Strategy, with respect to management direction for spotted owl habitat on the National Forests.

**Anderson and Burnham Report.** The Anderson and Burnham report raises issues that must be considered in determining if the selected alternative, the ISC Conservation Strategy, is still adequate to ensure the viability of the northern spotted owl.

**Other Species.** The Forest Service cannot adopt a plan which they know or believe will probably cause the extirpation of other native vertebrate species in the planning area.

### RESPONSE TO DEFECTS

To address the three defects in the FEIS identified by the Court, the Forest Service established the Scientific Analysis Team which included some of the members of the original Interagency Scientific Committee. These experts, in turn, conferred with additional scientists and specialists in preparing a detailed technical analysis of the three defects. The team's report, *Viability Assessments and Management Considerations for Species Associated With Late-Successional and Old-Growth Forests of the Pacific Northwest* (SAT Report), was published in March 1993.

As a result of President Clinton's Forest Conference on April 2, 1993, the Forest Ecosystem Management Assessment Team was established to identify options for management of late-successional and old-growth forests on Federal lands within the range of the northern spotted owl. To assure consistency of approach, this Assessment Team was to apply the Forest Service "viability" standard to lands administered by the BLM. The Assessment Team used the SAT Report in its analysis, and incorporated its key elements into many of their options.

The Forest Service and BLM were then directed by the Secretaries of Agriculture and Interior to supplement the FEIS (and other EIS documents) to assess the effects of the options prepared by the Assessment Team. Thus, the defects found by the Court are effectively addressed in the FEMAT Report and this Draft SEIS.

### Thirteen BLM Timber Sales

On April 19, 1993, the BLM withdrew the application for exemption from the Endangered Species Act for the 13 timber sales at issue, making the issue moot. (Babbitt 1993, Penfold 1993). In addition, this SEIS addresses management of lands administered by both the Forest Service and BLM, applying the viability standard to both agencies.

### Anderson and Burnham Report

After an extensive review of the issues raised by the Anderson and Burnham report (1992) in the Scientific Analysis Team Report (Thomas et al. 1993) and again in the FEMAT Report, the Assessment Team concluded:

> *Although most biologists seem to agree that spotted owl populations are declining, exact rates of decline are unclear. An analysis by Anderson and Burnham (1992) indicated that populations of adult female northern spotted owls on five study areas in Washington, Oregon, and California were declining at an average rate of 7.5 percent per year. The analysis also suggested that female survival rates were declining over time. The declining female rate was considered alarming because it could indicate a population that had passed some demographic threshold and was on an accelerating trajectory toward extinction (Harrison 1992; Karieva 1992; Orions 1992). This interpretation was challenged by Thomas et al. (1993), who argued that such a conclusion should not be drawn from the data collected during a period of transition from one habitat level to another. Thomas et al. (1993) suggested that it was highly unlikely that the owl population had declined below any demographic threshold, except possibly in some isolated and heavily cutover areas such as southwestern Washington. Dr. David Anderson (personal communication, 1993) challenged this conclusion, and the issue appears unresolved.*
>
> *Options 1, 2, 3, 4, 5, 6, and 9 were all rated as having an 80 percent or greater likelihood of providing sufficient habitat for a well-distributed population of northern spotted owls on federal lands over the next 100 years. An obvious question is how any option could have been rated this optimistically when the existing demographic information was taken into consideration. Our rationale was two fold. First, we question whether rates of population decline are as steep as is indicated by Anderson and Burnham (1992). The banding data that were analyzed by Anderson and*

> *Burnham are potentially subject to a number of biases. Our main concern is that emigration of adult and juvenile females may be causing female survival rates to be underestimated, which would result in an underestimate of the population growth rate. Second, it is questionable whether demographic rates estimated during a period of declining habitat can or should be used to evaluate whether a population will eventually stabilize at some new equilibrium (Thomas et al. 1990, 1993).*
>
> *Because of the above concerns regarding the interpretation of current demographic data, we believe that evaluation of efficacy of a particular option must be based largely on theoretical grounds relative to (1) the known size and distribution of existing populations (Thomas et al. 1990, USDI 1992c, Thomas et al. 1993), (2) the expected size and distribution of the future population under the proposed management scheme, and (3) the amount and distribution of habitat expected to be present during the transition period, including habitats other than old growth (e.g. table IV-11; figure IV-2). These factors were the basis for our evaluation of habitat sufficiency.*
>
> *While there is concern about the transition period, that concern is partially alleviated by the fact that the current owl population is still relatively large, despite 100 years of timber harvest within the range of the owl. We conclude that, as long as an extensive network of late-successional forests is protected, there will be little risk that the spotted owl population will drop below a viable level during the transition period. We readily admit that this conclusion cannot be proven. It is professional opinion, based upon our review of the evidence.* (Appendix A, Terrestrial Forest Ecosystem Assessment).

## Other Species

The underlying purpose and need for the proposed action is to adopt management direction for lands administered by the Forest Service and BLM within the range of the northern spotted owl to assure that late-successional and old-growth habitat is managed to maintain viable populations of vertebrate species. The Assessment Team developed a list of species likely to be closely associated with late-successional and old-growth forests. An analysis of the effects of each alternative was conducted for these species. Thus, the effects of all the alternatives on species known to be associated with late-successional and old-growth forests, and for which information is available, were fully evaluated.

# THE ECONOMY AND COMMUNITIES

The social and economic area affected by the alternatives presented in this Draft SEIS generally correspond to the range of the northern spotted owl, including western Washington, western Oregon, and northwestern California (see Chapter 1). The three states have a population that is growing at a higher rate than the national average. The 1990 population in the 57-county area was 7,291,325 people, with an urban population comprising nearly 74 percent of the total population. This reflects a significant change from the end of World War II when the National Forests and BLM Districts were opened for timber resource development, and the three-state area in the owl range had a 1950 population of 3.5 million people (less than half the current). At that time, urban centers contained 58 percent of the population. Today most of the citizens reside in the metropolitan areas of western Washington (Seattle-Tacoma), Willamette Valley from Eugene-Springfield to Portland-Vancouver), southern Oregon (Medford-Ashland), and northern California (Redding-Red Bluff). Transportation links are plentiful including the I-5 corridor connecting Canada and California; north-south U.S. highways 97, 99, and 101; east-west highways I-90, I-84, I-82, and U.S. 2, U.S. 12, U.S. 20, and U.S. 26; and major airports in Seattle-Tacoma and Portland. The Southern Pacific Railroad connects the West Coast, the Union Pacific Railroad connects to points east through Salt Lake City and Boise, while the Burlington Northern Railroad connects with the northern tier states.

People in the region have flocked to the major cities where jobs have been generally abundant, even during recessionary periods. The labor force employed in the farming, forestry, fishing, and mining sector in 1990 was 4.0 percent, in contrast to 10.8 percent in 1950. Also, employment in the manufacturing sector decreased to 17.9 percent in 1990 from 23.5 percent in 1950. Generally, over the last few decades, northwest employment in these sectors has gone through massive hiring, layoffs, and rehiring cycles based on a number of factors including national recessions, housing starts, fluctuating interest rates, changing productivity and efficiency standards, new technology, service-based employment, retail trade, etc.

Social and economic data were based on political boundaries and compiled from states and counties, which report information about their respective areas. There are 25 counties in western and central Washington, 24 counties in western and central Oregon, and 8 counties in northwestern California, all of which comprise the social and economic study area. Thus, the human dimension (socio-economic) analyses depend on secondary sources of information (U.S. Census Bureau data, as well as various national, state, and local data). In some instances, and as reported in the following forest resource descriptions, additional information has been gathered by FEMAT (see Appendix A, Economic Evaluation of Options).

This chapter does not present an analysis of the costs and benefits associated with the various alternatives in this Draft SEIS. As stated in the regulations, "For purposes of complying with the Act [NEPA], the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations" (40 CFR 1502.23).

Evaluation of many economic aspects of the alternatives were limited by resources and uses that have no market or transaction costs or benefits. The social component tends to rely heavily on qualitative evaluations by experts who know the areas or communities. Additionally, factors such as reductions in Federal employment due to implementation of the selected alternative in the Final SEIS or changes due to market conditions or public preferences are not factored into this analysis.

## TIMBER HARVEST

### Affected Environment

Each of the proposed alternatives will have a direct effect upon the level of timber harvest from forest lands administered by the BLM and the Forest Service within the planning area. Harvest and revenue from private or other publicly owned forests in the region will be indirectly affected.

### Methodology

The data necessary to do the analysis of allowable sale quantities were obtained through the construction of Geographic Information System (GIS) data bases. This system provides spacial information about land allocations.

The Federal forests of the region are managed under a nondeclining yield mandate which means that scheduled annual harvest levels can be maintained without decline over the long term if the planned schedule of harvests and regeneration is followed. The decadal harvest levels were estimated using a variety of techniques including linear programming (FORPLAN), simulation (TRIM-PLUS), and data base manipulation. These planning models simulate the acres treated and resource yields given the land allocations and management standards and guidelines. An analysis in support of the Forest Ecosystem Management Assessment Team (in preparation) used the term "probable sales quantity" (PSQ) to describe these results rather than "allowable sales quantity" (Johnson, K.N., Crim, K. Barber, and M. Howell. 1993. Timber Management Implications of Proposed Ecosystem Management Alternatives). The objective was to estimate sale levels likely to be achieved (PSQ) as opposed to estimating ceiling or upper-limit harvest levels (ASQ). Probable sale quantities are expected to be within 10 percent of actual results.

Some of the standards and guidelines for the various alternatives made it difficult to determine actual harvest levels. As an example, many of the alternatives require watershed analysis in "key watersheds" before timber harvest could occur. Estimates were made of probable sale levels using a set of interim rules for those watersheds. Also, several alternatives would designate "activity centers" for marbled murrelets and other species as they are found. These designations would preclude or restrict timber harvest. However, when PSQ predictions were made no allowance was made for these findings beyond sites that are already known. Finally, Alternative 9 designates "Adaptive Management Areas". The Assessment Team assumed that such designation would not reduce the sale level that would otherwise occur under the alternative. However, the actual level of sales that will occur in these areas is somewhat uncertain.

Probable sale quantities do not include volume that might be obtained under some alternatives from thinnings, salvage and other treatments from designated areas outside the matrix. An additional volume of up to 100 to 150 million board feet per year might be obtained from these activities depending on the alternative.

In order to assess the effects of changes in Federal harvests on regional timber prices and harvests from nonfederal sources, the timber market was simulated using the Timber Assessment Market Model or TAMM (details of the simulations are in Johnson, K.N., S. Crim, K. Barber, and M. Howell. 1993. Timber Management Implications of Proposed Ecosystem Management Alternatives. An analysis in support of the Ecosystem Management Assessment Team).

## Environmental Consequences

Estimates according to the BLM and Forest Service indicate that timber sales planned in Federal forests in the range of the northern spotted owl under the No-Action Alternative would have been 3 to 4 billion board feet per year in the 1990's, generating more that $1 billion annually in economic benefits in the Pacific Northwest. Under sustained yield plans, annual harvest levels from Federal forests had averaged 5.6 billion board feet during the period 1980 to 1989. The alternatives considered to protect the habitat of the northern spotted owl and associated late-successional species will restrict timber harvest in these forests, resulting in substantial social and economic costs.

The probable levels of Federal timber sales for the first decade for each alternative are summarized in Table VI-2, Historic Harvest and Probable Annual Timber Sales by Alternative and Figure VI-2, First Decade Timber Sale Levels for Alternatives and Historic Harvest Levels (Johnson, et al, 1993). Probable average annual sale levels by alternative in Table VI-2 are net volumes and do not include "other wood". Figure VI-2, however, includes "other wood" which is the volume of cull, salvage, and other products that is not normally part of allowable sale quantity calculations. Historically, this has accounted for about 10 percent of the total harvest volume from Federal lands in the planning area. Harvest of "other wood" is highly uncertain, however, due to changes in forest management standards and guides, such as retention of snags and large woody debris. Sale levels in subsequent decades do not increase to any notable extent.

The average annual value of harvest in the planning area was $650 million in 1990-1992. This represents the market value of the trees prior to harvesting. Log values to the mill in this period were over $1 billion per year and actual product values were substantially higher (logging and transportation costs were approximately $140/mbf ).

In the short term, timber sale quantities may differ from the calculated sustainable level due to required surveys and assessments, and to the time required to develop new timber sales that conform with the selected alternative (Appendix A, Economic Evaluation of Options). Coastal harvests will be restricted until the completion of marbled murrelet surveys, which may take 3 or more years. Harvests in many watersheds will be restricted until comprehensive watershed analyses are conducted, which may take several years. Finally, some sales in the current program may be located in designated areas and therefore, possibly unsuitable for harvest. The importance of short term sales is magnified because most of the current volume under contract on Federal lands will be liquidated this year (Appendix A, Economic Evaluation of Options).

**Table VI-2.** Historic harvest levels and probable annual average timber sales in the first decade by alternative. [1]

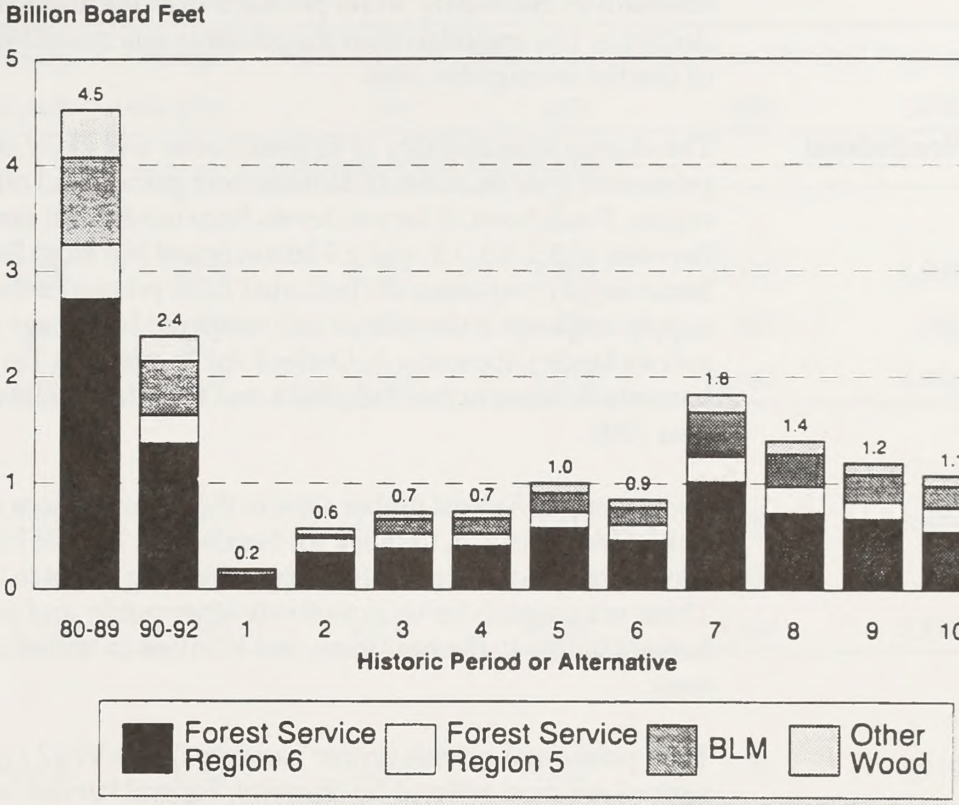
| Administrative Unit | Average Harvest 1980 -89 | Average Harvest 1990 -92 | Alternative [3] 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ---------------------------million board feet, Scribner--------------------------- | | | | | | | | | | |
| National Forests - Region 6 Owl Forests | | | | | | | | | | | | |
| W. Washington | 824 | 404 | 22 | 69 | 75 | 67 | 119 | 87 | 186 | 133 | 131 | 94 |
| E. Washington | 195 | 124 | 11 | 31 | 33 | 30 | 26 | 37 | 47 | 65 | 47 | 52 |
| W. Oregon | 1902 | 897 | 68 | 207 | 239 | 284 | 392 | 300 | 716 | 473 | 429 | 357 |
| E. Oregon | 127 | 100 | 15 | 45 | 45 | 37 | 49 | 47 | 65 | 53 | 59 | 52 |
| *Total* | *3048* | *1525* | *116* | *352* | *391* | *418* | *586* | *471* | *1014* | *724* | *666* | *555* |
| National Forests - Region 5 Owl Forests | | | | | | | | | | | | |
| *Total* | *561* | *291* | *20* | *127* | *132* | *106* | *146* | *141* | *242* | *246* | *152* | *220* |
| BLM - Owl Forests | | | | | | | | | | | | |
| W.Oregon/Calif. | 880 | 568 | 41 | 134 | 142 | 146 | 177 | 158 | 406 | 288 | 260 | 200 |
| E. Oregon | 35 | 5 | 0 | 3 | 3 | 3 | 6 | 4 | 7 | 6 | 6 | 4 |
| *Total* | *915* | *573* | *41* | *137* | *145* | *149* | *183* | *162* | *413* | *294* | *266* | *204* |
| **Total Owl Forests** | **4524** | **2389** | **177** | **616** | **668** | **673** | **915** | **774** | **1669** | **1264** | **1084** | **979** |
| National Forest - NonOwl Forests[1] | | | | | | | | | | | | |
| E. Washington | 134 | 138 | 102 | 102 | 102 | 102 | 102 | 102 | 102 | 102 | 102 | 102 |
| E. Oregon | 942 | 831 | 422 | 422 | 422 | 422 | 422 | 422 | 422 | 422 | 422 | 422 |
| **Total NonOwl Forests** | **1076** | **969** | **524** | **524** | **524** | **524** | **524** | **524** | **524** | **524** | **524** | **524** |
| **TOTAL** | **5600** | **3358** | **701** | **1140** | **1192** | **1197** | **1439** | **1298** | **2193** | **1788** | **1608** | **1503** |

[1] Probable sales levels should be within 10 percent of the final results and do not include "other wood" estimates. Historic numbers are "gross" volumes and do include historic levels of "other wood". Harvest numbers for 1990-1992 are estimates.

[2] NonOwl forest have not been subjected to rigorous analysis for the various alternatives.

[3] Volumes for alternatives 1,3 and 10 are approximated base on the analysis of the other seven alternatives.

**Figure VI-2.** First decade probable timber sale levels (PSQ) for alternatives and historic harvest levels.



At the present time, the Forest Service has approximately 1.8 billion board feet of timber under contract and 0.085 billion board feet offered but not awarded throughout the planning area. The BLM has approximately 0.235 billion board feet under contract and 0.232 billion board feet offered but not awarded. The Forest Service and BLM are conducting analyses of each of the "sales under contract" and "sales which have been offered but not awarded" to determine whether harvest of these areas should be allowed. The analyses include economic as well as conservation criteria. Based on these analyses, the agencies will determine which harvests can proceed as planned, which can proceed with minor modifications, and which should not proceed. At least one-third of the sales under contract are beyond any of the conservation zones, and should be allowed to continue as planned. In some cases, additional Endangered Species Act consultation with the Fish and Wildlife Service for the marbled murrelet is required. Other sales may have to be reconfigured to meet objectives for specific species, watersheds, and late-successional designated areas.

Estimated sale levels under all alternatives are below program levels of the 1980's, as well as below the harvest levels of 1990-1992 when most new Federal timber sales were enjoined. In 1990-1992, harvests consisted of sales under contract from the 1980's. The sale quantities of the alternatives will not permit 1990-1992 levels of timber harvest in the future. In the next 1 to 3 years, the outlook for sale levels is substantially less than the decadal average sales potential.

In addition to reduced harvest quantities in the decade ahead, wood quality is also apt to decrease. In the first decade, thinnings and other partial harvests would account for a large proportion of the volume harvested under the various alternatives. Secondary wood products manufacturers may see an even greater decline in raw materials than the probable sale quantities would indicate as a result of smaller average tree size.

### Role of Nonfederal Lands

The change in availability of Federal timber will likely affect regional forest product prices and spur increases in harvest from private and other public lands in the region. Predictions of harvest levels from nonfederal lands were estimated for harvests of 0.5, 1.0, 1.5, and 2.5 billion board feet from Federal forests (Table VI-11). Some supply responses are indicated from private timber owners. The level of the supply response is short lived and tempered by the age distribution of the timber on private lands (Appendix A, Outlook for Nonfederal Timber Harvests). Private harvests increase in the mid-1990's and then drop below levels of the 1980's by the year 2000.

Reductions in Federal timber sales in the planning area do spur price increases for timber (Appendix A, Outlook for Nonfederal Timber Harvests). All simulations show large price increases from the prevailing levels in the regional market in 1990. These price signals serve to motivate other public and private landowners to harvest timber in the near term, and to invest in timber management in the longer term.

Total public and private timber harvests (Table VI-12 ) give an indication of which regions are most affected by changing Federal harvest levels. In the State of Washington, total harvest levels are less affected than those in the other states. Federal harvests represent a much smaller proportion of the total harvest. Also, the predicted response of other landowners will tend to maintain harvests in Washington at a level somewhat higher than during 1990-1992. However, this will be 11 to 12 percent less than the level of the 1980's. Almost all of the harvest reduction in Washington is in the western region of the state.

Oregon harvests are predicted to decline under all alternatives compared to harvest levels of the 1980's. Alternatives 1 through 6 and 8 through 10 would decrease harvests on the eastside as well as the westside. Eastern Oregon harvests would be substantially reduced on Federal and nonfederal lands. Substantial reductions are also predicted for California under all alternatives due to reductions on both Federal and nonfederal lands (Tables VI-2 and VI-12).

Historically, a substantial portion of the nonfederal timber harvest was exported (Appendix A, Outlook for Nonfederal Timber Harvests). Export logs are the second most important forest product in the region in terms of volume and value. While some view these exports as a drain on the manufacturing industries, others view them as a vital part of the economy of the region.

Reductions in Federal timber harvests may result in increased domestic competition for logs currently exported. The combined effects of higher domestic prices, changing wood quality, and increased export of milled products has led many to

**Table VI-11.** Predicted decadal average timber harvest levels on nonfederal lands by geographic region for various Federal harvest levels (statewide for Oregon and Washington).

| Region | Average 1980-1989 | Average[1] 1990-1992 | Harvest Level from Federal Forests in the Owl Region 500 | 1000 | 1500 | 2500 |
|---|---|---|---|---|---|---|
| | ---------------------------million board feet, Scribner--------------------------------- | | | | | |
| Washington | | | | | | |
| Western | 4,126 | 3,775 | 4,253 | 4,193 | 4,157 | 4,008 |
| Eastern | 822 | 752 | 848 | 822 | 810 | 803 |
| *Total* | *4,949* | *4,528* | *5,101* | *5,015* | *4,967* | *4,811* |
| Oregon | | | | | | |
| Western | 3,023 | 2,855 | 3,569 | 3,519 | 3,489 | 3,364 |
| Eastern | 604 | 688 | 488 | 465 | 455 | 449 |
| *Total* | *3,627* | *3,543* | *4,057* | *3,984* | *3,944* | *3,813* |
| California | | | | | | |
| Owl Region | 1,640 | 1,783 | 1,361 | 1,327 | 1,287 | 1,219 |
| *TOTAL* | *10,216* | *9,854* | *10,519* | *10,326* | *10.198* | *9,843* |

Source: TAMM simulations

[1] Values for California are the average for 1990-1991. Volumes were estimated for Oregon and Washington for 1992.

**Table VI-12.** First decade historic and predicted average timber harvest from all lands by geographic region for a range of harvest levels from Federal forests.

| Region | Average 1980-1989 | Average 1990-1992 | Harvest Level from Federal Forests in the Owl Region 500 | 1000 | 1500 | 2500 |
|---|---|---|---|---|---|---|
| | ---million board feet, Scribner--- | | | | | |
| Washington | | | | | | |
| Western | 4,940 | 4,179 | 4,299 | 4,292 | 4,315 | 4,303 |
| Eastern | 1,151 | 1,104 | 972 | 983 | 1,002 | 1,038 |
| *Total* | *6,091* | *5,193* | *5,271* | *5,275* | *5,317* | *5,341* |
| Oregon | | | | | | |
| Western[1] | 5,805 | 4,320 | 3,837 | 4,062 | 4,323 | 4,821 |
| Eastern[2] | 1,708 | 1,624 | 880 | 917 | 951 | 992 |
| *Total* | *7,513* | *5,944* | *4,717* | *4,979* | *5,274* | *5,813* |
| California | | | | | | |
| Owl Region | 2,201 | 2,074 | 1,436 | 1,477 | 1,512 | 1,594 |
| *TOTAL* | *15,805* | *13,211* | *11,424* | *11,731* | *12,103* | *12,748* |

[1] Western Oregon figures include a small amount of harvest from BLM administered lands in northern California.

[2] Harvest levels from nonowl forests have not been subjected to rigorous analysis for the various alternatives and appear only for regional price projections. Harvest levels from eastside forests are uncertain at the present time.

conclude that there will be substantial reductions in log exports from the region. From 1988 to 1992, log exports in the region did fall from 3.7 to 2.5 billion board feet (a 32 percent reduction). It is predicted that this level of export will continue into the decade ahead assuming no change in nonfederal log export policies.

In summary, the effects of Federal harvest reductions on nonfederal lands will vary by state. While Federal harvest reductions will not be buffered to any great extent by increases in nonfederal harvest levels in Oregon and California, they will be in Washington.

Mills could see some increased supply from a redirecting of log exports to domestic markets. Market forces, however, have already caused a reduction in log exports to a level that is expected to remain stable during the decade ahead.

## MINERAL RESOURCES

### Affected Environment

Minerals are divided into three classes for management purposes: locatable, salable, and leasable minerals. The manner in which each is managed and the authority of the Federal agencies to control the exploration for and development of each management class varies.

Locatable minerals are those metallic and nonmetallic minerals for which the 1892 Mining law gives United States citizens the statutory right to prospect for, locate, and develop claims on public domain lands. All valuable mineral deposits on lands open to mineral entry are locatable unless excluded because they are leasable or salable. Gold, silver, copper, and zinc are examples of minerals which are generally locatable. Locatable minerals occur throughout the range of the northern spotted owl.

Salable minerals are common varieties of sand, stone, gravel, pumice, pumicite, cinders and clay. In general, these minerals are of widespread occurrence, of relatively low unit value, and are generally used for construction materials or for road building purposes. Disposal of salable minerals from public lands is totally at the discretion of the Federal agencies.

Leasable minerals include those minerals that can be leased under one of the several mineral leasing acts. In northern California, western Oregon, and western Washington, the leasable mineral commodities include oil and gas, geothermal energy, coal, and metallic minerals on acquired lands.

Federal lands in the planning area are known to include substantial mineral resources. For example, the 1992 analysis of critical habitat designation for the northern spotted owl (Appendix A, Economic Evaluation of Options) provided preliminary assessments of the potential effects of limiting mining activities within the lands designated as being critical habitat for the northern spotted owl.

At least ten known mineral resource deposits are located within critical habitat, including seven in Jackson and Josephine counties in Oregon. These minerals include lime, limestone, silica, copper, zinc, gold, silver, and chrome. Of these 10 known deposits, 1 is currently being mined, 3 others could be profitably mined at 1990 prices, and 4 more could be profitably mined given a doubling of mineral prices. The mineral resources from the currently profitable mines are estimated to have a value of $344 million. It should be noted that this value includes the one active operation and the potential contributions from the other operations.

In addition to known reserves with some current activity or potential activity, the Geological Survey (USDI) identified three mineral terranes in southwestern Oregon and the "copper porphyry" terrane that corresponds roughly to the Cascade Range in Washington, Oregon, and northern California as being mineral terranes with substantial potential for yielding future discovery of deposits. The copper porphyry terrane, in particular, appears to hold great potential for mineral deposits that may be within the bounds of designated areas. This terrane contains silver, gold, molybdenum, and copper, and holds the potential for production of hundreds of millions of dollars worth of minerals.

The entire Cascade Range of Washington and Oregon, as well as the eastern halves of the Klamath and Shasta-Trinity National Forests and 40 percent of the Mendocino National Forests in California, are prospectively valuable for geothermal resources. Geothermal exploration has been localized with little disturbance to each site. The location of drilling sites for exploration has been flexible; therefore, environmentally sensitive sites usually have been avoided.

Areas of Federal forests in Oregon and Washington are prospectively valuable for oil and gas resources. There are no prospective oil and gas resources within the four northern California National Forests.

In the long term, it is likely that additional mineral deposit discoveries will lead to further activities in mining and mineral processing in the region. The level of expansion in these industries may be limited under the alternatives.

## Environmental Consequences

The effect of the alternatives on mineral and energy resources is directly related to the areas that would be withdrawn from mineral leasing or constraints placed on the development of those resources. Withdrawal of areas from leasing may not be necessary, since energy exploration and development activities affect very few acres. A more likely effect would be mitigation measures attached to mineral leases and plans for locatable mineral development designed to protect habitat for spotted owls and other old growth related species.

Salable mineral development typically takes the form of small sand and gravel pits, usually on the order of 1 acre in size. Because of the inherent low value of salable minerals, they are usually extracted close to the surface of the ground and where they will be used. It would be unusual to need to develop such a source within a designated area.

The development of mineral resources may be limited by the land allocations and standards and guidelines proposed in the alternatives. However, the more likely effect of designating areas for habitat for the northern spotted owl and other old-growth related species would be that additional measures to protect habitat would be required under mineral leases and in plans for locatable mineral development. This would tend to increase the costs of extracting minerals and result in less mining in these areas.

## RANGE/GRAZING RESOURCES

**Affected Environment**

Federal lands of the west are often leased for grazing. This use of Federal lands for grazing in Oregon, Washington, and northern California is far more prevalent east of the Cascade Range than within the range of the northern spotted owl. Within the range of the northern spotted owl, lands administered by the BLM historically provided about 23,000 animal unit months (AUMs) while National Forests have provided about 213,000 AUMs. This contrasts to 510,000 AUMs on the remainder of the National Forests in the Forest Service's Pacific Northwest Region.

**Environmental Consequences**

Modification of grazing practices would occur under all the alternatives, particularly in the riparian reserves. These modifications would likely have consequences for individual permitees. The Assessment Team concluded that the consequences to the industry would be minimized by the relatively minor amount of range production on Federal lands within the planning area.

## SPECIAL FOREST PRODUCTS

**Affected Environment**

There is a great deal of interest in the role that nontraditional or "special" forest products might play in the region. Currently, there are five major segments within the industry: (1) floral greens, (2) Christmas ornamentals, (3) wild edible mushrooms, (4) other edibles and medicinals, and (5) Pacific yew (*Taxus brevifolia*). These products appear to have a significant amount of economic value, however, their contribution is largely unknown because of below market pricing by public owners and a lack of record keeping.

The major market segments are floral greens, Christmas ornamentals, and edible mushrooms. The Pacific yew will have less demand in the future in light of the development of synthetic taxol. In 1989, approximately 27 million bunches of floral greens, 4,000 tons of moss, 15,000 tons of Christmas boughs, 1,000 tons of holly, and 7 million cones were harvested from the forests in the region with a value of over $42 million. In 1992, mushroom harvests totaled 1200 tons, with a value over $12 million (Appendix A, Economic Evaluation of Options). It must be noted that these are the values of the sales of these products, not the receipts to the government, as these products are rarely marketed by the Federal government. Instead, permits are often issued for nominal fees.

The medium-to-low elevation western hemlock zone of the region appears to hold the greatest potential for supporting special forest products activity. Also, the higher elevation mountain hemlock zone is very productive for high-valued beargrass (*Xenophyllum tenax*). These forest types are well represented within the planning area for this SEIS.

**Environmental Consequences**

Silvicultural prescriptions can enhance the production of special forest products. Most floral greens thrive in management regimes that maintain the forest in mid- to late-seral stages and maintain semi-closed canopies. Thus, the value of these products can be enhanced through maintenance of stands in this condition as in Alternatives 1 through 6. Christmas ornamentals are less sensitive to stand structure, and information is not yet available on management associations of other special products. Use of Pacific yew could be restricted by alternatives that designate more forest areas to northern spotted owl habitat and other protected areas since much of the yew harvest is the result of logging or roading activities (USDA 1993).

## COMMERCIAL FISHERIES RESOURCES

### Affected Environment

While commercial fisheries production is not a direct output of the forest, it is influenced by the quality of the stream habitat within the forested areas. Fisheries-related industries represent a significant proportion of the coastal economy of the Pacific Northwest. The principle commercial species categories in the region are salmon, tuna, groundfish, crab, and shrimp. While salmon are the species most directly impacted by forest management activities, it is important to look at all species landed to see how the industry has adapted to changing conditions. Forested watersheds can have marked impacts on the habitat of these fish species. While not attributable solely to forest conditions, the catch rates and angler days for Pacific Northwest salmon fishing have declined dramatically from the late 1970's.

The volume and value of commercial seafood landed in Pacific Northwest ports fell substantially from 1989 to 1991 (Table VI-6, Appendix A, Economic Evaluation of Options). The most significant decline occurred in salmon catch. A variety of factors contributed to this, including depressed fish prices, unfavorable ocean conditions, and increased competition.

Short-term changes cannot be extrapolated to determine long-term projections. The seafood catch in the early 1980's, for example, declined greatly with unfavorable economic conditions coupled with El Nino conditions. However, there is evidence of a long-term shift in the Pacific Northwest fishing industry from salmon and tuna production towards groundfish and shrimp. This species substitution has helped sustain the commercial fishing fleet. Three factors, however, pose difficulties for the coastal fisheries at the current time: (1) the recession in world seafood prices, (2) continued reductions in salmon availability, and (3) the loss of a large share of the groundfish (particularly Pacific whiting) to offshore processors (Appendix A, Economic Evaluation of Options).

### Environmental Consequences

None of the alternatives presented in this Draft SEIS are likely to influence the immediate future of commercial fisheries operations. However, improved watershed and fisheries management policies could aid in the production of high value salmon in the long term. Generally, the more protection an alternative provides for a stream and its riparian habitat, the more potential benefit there is to fish habitat and fish populations. In the long-term, improved watershed protection may aid in the production of commercial fisheries.

## RECREATION RESOURCES

### Affected Environment

Federal forests within the range of the northern spotted owl provide significant opportunities for people to enjoy the outdoors. Forest based recreation in 1990 totaled 135 million visits. Estimates of willingness to pay suggest that forest visitors placed a value of over $1.6 billion on these visits (over and above their actual expenditures of $2.8 billion) (Appendix A, Social Assessment of Options). People choose their recreation experience from a variety of settings, activities, and experiences.

The broad spectrum of recreation opportunities has been organized along a framework called the Recreation Opportunity Spectrum (ROS). The system classifies the land base by broad categories of recreation potential: primitive, semiprimitive nonmotorized, semiprimitive motorized, roaded natural, and roaded modified rural. For recreation supply/demand overall, there is evidence of an excess supply of the more developed, motorized forms of recreation (Table VI-9, Appendix A, Economic Evaluation of Options). Additionally, there is a high and increasing demand for recreation settings with little development, little management activity, and no motorized access. There are about 5.5 million acres in the planning area currently allocated to primitive and semiprimitive, nonmotorized recreation. Demand for this recreation is forecasted to reach nearly 13.5 million acres by the year 2000 (Appendix A, Economic Evaluation of Options).

While land classifications can be useful for describing some aspects of recreation value, they are not sufficient for describing hunting and fishing opportunities and values. Pacific Northwest hunting and fishing represents one of the highest valued recreation opportunities in the region. Sport fisheries activities are dominated by trout, salmon, and steelhead fishing (77 percent of all fishing days were in pursuit of these species) (Appendix A, Economic Evaluation of Options).

## Environmental Consequences

The range of alternatives addressed in this Draft SEIS indicate little variation in recreation opportunity. Alternatives 1, 3, 4, 5, 8, and 9 could lead to improved primitive and semiprimitive recreational opportunities with the elimination of roads for watershed restoration.

Over half of the primitive and semiprimitive nonmotorized acreage is in the matrix in both Alternatives 1 and 7. Two-thirds of the primitive and semiprimitive nonmotorized acreage in California and Washington would be in the matrix under Alternative 1. Alternative 7 has 6 percent, or over 100,000 acres, less in the matrix than Alternative 1 (Appendix A, Social Assessment of Options).

Noise has an impact on wildlife and on the quality of the recreation experience. Limitations on road and landing construction under Alternatives 1, 3, 4, 5, 8, and 9 will place increased emphasis on helicopter logging. Helicopter noise can disturb the northern spotted owl and other late-successional and old-growth related species during nesting season. Numerous military flight corridors utilize airspace above Federal lands for training exercises. Helicopter noise and noise associated with occasional sonic booms and nearby aircraft may interfere with the quality of recreation in roadless areas and Wilderness. Helicopters at 500 feet are comparable to sound levels of heavy trucks and city buses heard from the street, which could be considered a significant impact in areas with very low ambient noise levels. Possible mitigation measures could include altering flight paths and seasonal and daily avoidance of high use areas.

For recreation values, the alternatives provide additional primitive nonmotorized recreation opportunities and create more natural-appearing landscapes consistent in many ways with objectives associated with the designated areas (Appendix A, Economic Evaluation of Options).

## WATER QUALITY

**Affected Environment**

Water quality plays an important role in ecosystem function on Federal lands. Primary factors affecting water quality are erosion and sedimentation resulting from forest management activities, and increased temperatures resulting from removal of shade-producing riparian vegetation along streams.

The Federal Clean Water Act directs Federal agencies to comply with state water quality requirements to restore and maintain water quality necessary to protect identified beneficial uses. The Forest Service and BLM are the designated management agencies charged with implementing and enforcing natural resource management programs for the protection of water quality on lands under their jurisdiction.

**Environmental Consequences**

The potential effects of current plans and draft plan preferred alternatives on water quality, and the processes for controlling these effects, are addressed in the respective agency planning documents. These existing planning documents most closely address the conditions reflected under Alternative 7. All other alternatives provide increased reserves in riparian areas, particularly key watersheds. This is especially true for Alternative 9 which is largely based on protection of riparian areas. Implementation of Alternative 9, including monitoring and adaptive management, will enhance water quality protection and contribute to attaining and maintaining water quality standards.

## SCENIC QUALITY, AIR QUALITY AND OTHER "PUBLIC GOODS"

**Affected Environment**

Contributions from the forests of the region extend beyond commodities. The noncommodity outputs of the forest are based on human values and can provide a basis for regional development, both through tourism-related activities and quality of life considerations. Many people contend that economic growth in the Pacific Northwest has been fueled by the quality of life in the region, and that environmental quality is a component of this quality of life.

Landscapes managed for visual resources include those kept in a natural state (preservation visual quality objective), those managed to appear natural or slightly altered (retention and partial retention visual quality objectives), and those moderately to heavily altered by human activity (modification and maximum modification visual quality objectives). Preservation visual quality objectives allow only ecological changes in the landscape; retention objectives require that management activities not be visually evident.

**Environmental Consequences**

All alternatives would provide for visual quality objectives identified in current plans and draft plans preferred alternatives. In alternative 1, over half of the area currently managed for retention and preservation visual quality objectives would be located in the matrix. While the percentage located in the matrix is highest for Alternative 7, particularly in California, there are not many differences among the three states. (See Appendix A, Social Assessment of Options.)

Research on preferred visual landscapes in forest settings shows that management direction complies with the public preference for more naturally-looking landscapes. Driving for pleasure is the recreational activity of greatest demand on federally administered lands. Landscapes within designated areas would likely be more appealing for sightseeing as well as a more desirable backdrop for other recreational activities such as camping, hiking, etc., than areas subject to intensive timber harvesting. For scenic values, the alternatives present opportunities to create more natural appearing landscapes which are consistent in many ways with objectives associated with the designated areas.

Pacific Northwest forest ecosystems are not static. Change by growth, succession, and agents of disturbance (e.g., fire, wind, insects and disease) is an inherent part of these ecosystems. In general, those alternatives that provide for greater amounts of designated areas will lead to ecosystems with fewer signs of modification by humans. Air quality may benefit from less human activity (e.g., broadcast burning, mining, road construction, and use of unpaved roads), but in forest types frequented by fire, those alternatives precluding management (e.g., thinning and the judicious use of prescribed fire) may lead to castrophic fires and a net decline in air quality (USDA 1992).

## REGIONAL EMPLOYMENT

### Affected Environment

Discussions of employment in each of the natural resource sectors focus on direct employment, not "indirect" or "induced" effects caused by changes in industrial purchases and household expenditures within a region. Under all of the alternatives, direct employment in timber harvesting and processing will decline as a result of reduced harvest levels.

### Timber-based Employment

Timber-based employment in 1991 was approximately 120,000 wage and salary employees (Appendix A, Outlook for Regional Employment). An additional 12,000 (10 percent) are self employed. The wage and salary employees are divided among sectors: 17,000 in logging, 32,000 in milling, 13,000 in veneer and plywood manufacturing, 25,000 in secondary wood products, 6,000 in miscellaneous solid wood products, and 27,000 in pulp and paper. Total wage and salary employment in the timber industry is down from the post 1980's recession high of 152,000 employees. It is estimated that employment had dropped to 144,900 in 1990 and 125,400 employees by 1992. Employment levels are predicted to vary from 112,000 to 125,000 for the next decade.

The role of timber in the regional economy has changed over the last 25 years. During the period 1985 to 1989, timber-based employment represented approximately 5.1 percent of regional employment (Table VI-13). This was down from 9.5 percent in the early 1970's due largely to diversification within the region's economy led by growth in the nonmanufacturing sectors. Subregional differences were, however, substantial. The Pacific Northwest is still heavily timber dependent outside the influence of the Portland and Seattle metropolitan areas, although less so than 20 years ago.

**Table VI-13.** Timber industries and total employment by subregion in the study area.[1]

| | 1970-1974 Average | | | 1985-1989 Average | | |
|---|---|---|---|---|---|---|
| | Employment | | | Employment | | |
| State/Region | Total | Timber | Timber as % of Total | Total | Timber | Timber as % of Total |
| | --thousands-- | | - percent- | --thousands-- | | -percent- |
| Washington - | | | | | | |
| Olympia Peninsula | 83.7 | 16.6 | 19.84 | 127.9 | 13.2 | 10.32 |
| Puget Sound | 702.7 | 23.4 | 3.33 | 1205.3 | 21.6 | 1.79 |
| Lower Columbia | 65.0 | 16.0 | 24.58 | 101.0 | 13.0 | 12.88 |
| Central | 72.2 | 3.4 | 4.75 | 118.7 | 3.7 | 3.10 |
| *Total* | *923.6* | *59.4* | *6.43* | *1552.9* | *51.5* | *3.31* |
| Oregon - | | | | | | |
| Northwest | 411.8 | 16.9 | 4.12 | 690.9 | 19.9 | 2.88 |
| West-Central | 103.2 | 24.6 | 23.87 | 176.3 | 19.7 | 11.18 |
| Southwest | 76.8 | 23.7 | 30.83 | 121.9 | 21.3 | 13.31 |
| Central | 33.8 | 7.1 | 21.14 | 59.5 | 8.5 | 14.22 |
| *Total* | *625.6* | *72.4* | *11.57* | *1048.3* | *69.4* | *6.62* |
| California - | | | | | | |
| Total | 67.4 | 21.0 | 31.23 | 106.5 | 16.3 | 15.26 |
| All States | | | | | | |
| *TOTAL* | *1616.6* | *152.8* | *9.45* | *2707.7* | *137.2* | *5.07* |

Source: Greber (1992)

[1] Does not include self-employed individuals. Add approximately 10 percent to estimate total employment in timber industries. Timber industries include solid wood products (inclusive of mobile home manufacturing) and pulp and paper processing (inclusive of paper converting).
The study area includes the counties that fall, whole or in part, within the range of the northern spotted owl.

Recreation/Tourism-based Employment In the 14 coastal counties in the planning area, it is estimated that tourism directly supported wages totaling $348 million in 1990. Assuming an average annual wage of $15,000 to $20,000 per full-time worker, 17,000 to 23,000 full-time workers were directly supported by the tourism industry in the coastal counties. The actual number of people employed in the industry is likely much higher because the work tends to be seasonal and part time. It is, however, a large and important part of the coastal economy. In the short term, the alternatives proposed will not change the nature of coastal tourism. In future decades, however, restoration of salmon and trout runs could have marked effects on coastal recreation activities.

Thousands of people are supported by the inland recreation industry. The BLM estimates that 900 recreation and tourism jobs were directly attributable to management of the lands they administer. Based on expenditure data (Appendix A, Outlook for Non-Commodity Production) and an estimated income from recreation and tourism of 41 cents for every dollar, 50,000 to 80,000 full-time jobs may be directly attributable to forest based recreation activities on lands administered by the Forest Service and BLM. Of these jobs, it is estimated that 4,000 to 5,000 are related to jobs created by fishing opportunities. The land allocations of the alternatives may provide more of the recreation opportunities that are currently supply limiting (Appendix A, Outlook for Noncommodity Production). Thus there should be some gains to recreation and tourism-based employment in the inland communities. The extent of these gains, however, is uncertain.

### Commercial Fisheries Employment

Based on figures for 1991 for Washington, Oregon, California, and Alaska, 0.037 full-time equivalent jobs were supported per thousand pounds of fish landed. Similarly, in 1992 an estimated 15,108 jobs in Oregon were supported by $141.5 million worth of fish landed. Income from fish harvesting and processing represents 38 percent of the total income and approximately one half of the full-time equivalent jobs(direct, indirect, and induced) from this level of fish harvest (Appendix A, Outlook for Regional Employment). Based on these estimates, the fish landed in 1991 in Washington, Oregon, and northern California would have supported approximately 5,000 full-time equivalent workers in the fisheries industry.

Of these 5,000 jobs, less than 10 percent are directly related to the commercial salmon industry. This low percentage reflects a combination of growth in the importance of other species and the current low levels of salmon catch.

### Other Natural Resources-based Employment

Statewide in Washington in the late 1980's, there were approximately 12,000 people employed in mining and mineral processing; in Oregon, this number was 6,700 (note many of these jobs are in the eastern reaches of the state, outside the planning area, and some are on private lands). Northern California statistics are not available. Many of the minerals processed in the region came from Federal lands.

The 1992 assessment of northern spotted owl critical habitat designation estimated that 4 of the 10 mineral deposits within critical habitat could be profitably mined at prevailing mineral prices and that approximately 300 jobs would be associated with this mining and mineral processing activity. It should be noted that this employment level includes the one active operation and the potential contributions from the other operations. The vast mineral terranes in the region hold the potential for thousands of additional jobs in the region as new deposits are discovered. The copper porphyry terrane, in particular, appears to hold great potential for revealing mineral deposits that might be within the habitat of the northern spotted owl and other late-successional and old-growth related species. This terrane contains silver, gold, molybdenum, and copper, with the potential for production of hundreds of millions of dollars worth of minerals and several thousand mining and mineral processing jobs.

Jobs directly attributable to range and grazing activities are quite low. Estimates for the number of jobs directly involved in cattle production per 1,000 animal unit months vary from 0.3 to 1.0. Based on these ratios, 69 to 236 livestock jobs would be attributable to the 236,000 AUMs currently produced on Federal lands in the planning area.

The floral greens, Christmas ornamentals, and mushroom segments of the special forest products markets produced over $70 million in harvests in 1992 and provided employment opportunities for an estimated 28,000 to 30,000 individuals in the region. As many as one-half of these individuals are involved with the harvesting or processing of two or more of the special products due to the sequential and seasonal nature of the work (Christmas ornamentals in late fall and early winter, edible mushrooms in spring, and floral greens in all but the spring seasons). Most of the harvesting and processing jobs are not full-time and are seasonal, low paying, and without benefits. Thus, these numbers cannot be compared directly with other employment statistics. There does, however, appear to be economic potential in the processing and marketing of these special forest products. The extent of such possible developments is unknown.

## Service Employment in Forestry

Employment effects within the timber-based employment section (above) focus only on logging and wood processing jobs. There are an estimated 6,000 additional jobs in the forestry services sector. These jobs have been primarily in reforestation and timber stand improvement work. Two factors will influence future employment in the forestry services sector: (1) fewer acres of harvest will reduce the need for reforestation, fertilization, precommercial thinning, and other timber stand improvement work and (2) proposals under the alternatives for assessments, surveys, and inventories. These activities, as well as recommendations for watershed restoration and forest stand improvement, would offset some of the employment declines in the forestry services sector.

The Bureau of Land Management's Draft Resource Management Plans assumed that the effect on the forestry services sector ranged from 0.3 to 0.6 jobs per million board feet of timber harvest. Thus a two billion board foot reduction in timber harvests in the region would result in the displacement of 600 to 1,200 forestry services workers.

Additional investments on lands with a planned timber harvest (the matrix) would reduce job losses in the forestry services sector. An aggressive timber stand improvement and pruning program could add 800 or more jobs per year over the next decade and promote the yield of higher quality, higher valued wood in future decades in Washington and Oregon.

Reforestation activities would support an additional 500 jobs on lands administered by the Forest Service over 3 years, and an estimated 200 jobs on lands administered by the BLM for one year.

Northern spotted owl inventory and monitoring are estimated to cost $6.1 million per year. Most of this cost is labor. Assuming a total cost of $30,000 per job, this translates into 200 jobs per year. Marbled murrelet surveys are estimated to require approximately 200 employees for 5 months per year for the next 2 to 3 years (weather depending).

Watershed restoration activities are receiving increasing attention in the region. Forest Service estimates of stream and watershed restoration activities indicate the potential for 2,500 jobs in Oregon and Washington over the next 3 years. Additional jobs may be possible on lands administered by the BLM.

The Forest Service has identified approximately 3,800 jobs in Oregon and Washington that are related to other ecosystem restoration activities.

In summary, silvicultural activities, surveys, assessments, and restoration work could provide 7,000 jobs per year over the next 3 years. Program costs, however, would be substantial as estimated budget requirements are in excess of $250 million per year.

## METHODOLOGY

Using Forest Service economic data and the input-output model IMPLAN, it was estimated that each million board feet of change in timber harvest effects approximately 7.8 jobs in the solid wood products industry (Table VI-14). In addition, historic wood utilization indicated 1.29 pulp and paper industry jobs for each million board feet of timber harvested. These job estimates are based on 1989-1990 average harvests and 1990 employment levels. The harvests are distributed by percentages according to 1988 mill survey statistics. To discuss subregional differences, the survey units used by the Forest Service for conducting periodic surveys of forest product industries have been adopted. While the IMPLAN coefficients are useful for showing a snap shot of the current economy, they do not capture the dynamics in an economy and thus do not distinguish between actual job losses and lost opportunities in the economy. For example, industries effected by the indirect effects may reposition themselves to serve other markets and, while current workers may not be displaced, future growth in the sector may be curtailed.

In order to demonstrate the dynamics in the economy, the state economist in Oregon and the economic forecast council in Washington performed forecasts using their respective state economic and revenue forecasting models. While these models predict that lower harvest levels curb expansion, there is still growth in the regional economies (Appendix A, Outlook for Regional Employment). These statewide forecasts, however, mask the subregional differences where the rural economies are shrinking while metropolitan economies are expanding. The new job holders in the region do not necessarily correspond to the job losers elsewhere in the region. There will be dislocations from rural communities.

The harvest levels assumed by region and by alternative are displayed in Table VI-15. These are based on the harvest levels summarized in Table VI-2 and interpolation of the data appearing in Table VI-11. Within half-state regions, the harvests are distributed by percentages according to 1988 mill survey statistics. The resulting projected employment in timber industries is portrayed in Table VI-16

**Table VI-14.** Average timber industries employment affected per million board feet of timber harvest processed by subregion in the study area (inclusive of self-employed individuals).[1]

| State/Region | Solid Wood Products[2] | Pulp and Paper[3] | Total |
|---|---|---|---|
| | -----jobs per million board feet, Scribner----- | | |
| Washington - | | | |
| Olympic Peninsula | 4.37 | 1.01 | 5.38 |
| Puget Sound | 9.67 | 1.74 | 11.41 |
| Lower Columbia | 5.94 | 5.58 | 11.52 |
| Central | 10.28 | 0.00 | 10.28 |
| Oregon - | | | |
| Northwest | 9.16 | 2.81 | 11.97 |
| West-Central | 9.11 | 2.62 | 11.73 |
| Southwest | 9.07 | 0.37 | 9.44 |
| Central | 16.38 | 0.00 | 16.38 |
| California - | | | |
| Total | 5.77 | 0.63 | 6.40 |
| All States - | | | |
| Total | 7.79 | 1.29 | 9.08 |
| All States - by Sector | | | |
| Logging | 1.62 | | |
| Sawmilling | 3.08 | | |
| Veneer & Plywood | 1.33 | | |
| Millwork | 0.82 | | |
| Other Wood Products | 0.95 | | |
| Pulp | | 0.17 | |
| Paper Processing | | 1.11 | |

[1] The study area includes the counties that fall, whole or in part, within the range of the northern spotted owl.
[2] Solid wood products does not include statistics for mobile homes and prefabricated wood buildings.
[3] Paper converting is not included in the statistics.

employment is based on harvests multiplied by IMPLAN based jobs/MMBF). Table VI-16 compares the projected employment levels to employment in 1990 and estimated employment in 1992.

Projections of job ratios and employment have not been adjusted for future changes in technology. Technology can increase jobs per unit of input when the focus is on saving raw materials and product-improving technology changes. Since raw material is apt to be the limiting resource, technology in the decade ahead will likely focus on saving raw material as opposed to saving labor.

The job ratios in Table VI-14 vary significantly by subregion. The variation is based on the tree species processed, the types of mills in the subregions, the amount of secondary manufacturing, and the level of exports from the region. For example, the jobs per million board feet are much higher than average in central Oregon where there is a substantial amount of secondary wood products manufacturing which is tied to the species processed in the subregion. The Olympic Peninsula, on the other hand, shows lower jobs per million board feet, due to the amount of logs shipped into the region that are exported and the lack of secondary manufacturing activity.

## ENVIRONMENTAL CONSEQUENCES

The projections for the pulp and paper industry indicate no change in total employment. This is not to suggest that there will be no effects in the pulp and paper sector, it only suggests that the industry will respond to supply induced changes in ways different from the solid wood products sector. Of the 28,000 employees in the pulp and paper sector, less than 3,000 work in the pulp sector, while 16,000 work in paper processing and 9,000 are employed in paper converting.

The paper converting sector uses paper from the national and global market; there is a weak, direct relationship between harvest levels and this portion of the pulp and paper market. The paper market has already begun to respond to changing market conditions by installing increased paper recycling capacity that can buffer it from changes within the pulp processing sector. In addition, there is a vast supply of open-market pulp available on the global market.

While the pulp sector is apt to be the most affected of the pulp and paper sectors by changes in forestry activity, utilization of alternative species and improved pulp recovery processes can allow these industries to supply existing plant capacities. Capital investment, however, is apt to be required and the current market for pulp is plagued by weak prices. There is also a large quantity of chips exported from the region; some will likely be redirected to domestic pulp mills.

Similarly, mobile home construction (which is typically included with the timber industry employment statistics) is assumed to maintain historic employment levels. Employment in this sector is included in the projections in Table VI-16 at its 1990 level.

In summary, these projections imply a range of job displacement from 1,700 to 12,500 jobs relative to 1992. However, compared to 1990 employment levels these projections predict displacement of 21,200 to 32,000 thousand jobs. The majority of the jobs affected are located in Oregon, and are concentrated in southwestern Oregon.

**Table VI-15.** Historic and projected volume processed per year in the next decade from all owners, by subregion of the study area and alternative.[1]

| State/Region | Average Harvest 1980-89 | 1990-92 | Alternative 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | -----------million board feet, Scribner--------------- | | | | | | | |
| Washington - | | | | | | | | | | | | |
| Olympic Peninsula | | 1914 | 1970 | 1978 | 1977 | 1974 | 1980 | 1975 | 1967 | 1971 | 1977 | 1966 |
| Puget Sound | | 1320 | 1415 | 1423 | 1423 | 1420 | 1418 | 1423 | 1416 | 1429 | 1419 | 1424 |
| Lower Columbia | | 982 | 894 | 910 | 911 | 911 | 924 | 914 | 931 | 922 | 925 | 912 |
| Central | | 353 | 313 | 333 | 335 | 332 | 336 | 337 | 345 | 358 | 335 | 348 |
| *Total* | *5661* | *4569* | *4592* | *4644* | *4646* | *4637* | *4658* | *4649* | *4659* | *4680* | *4656* | *4650* |
| Oregon - | | | | | | | | | | | | |
| Northwest | | 1442 | 1401 | 1446 | 1452 | 1462 | 1492 | 1464 | 1602 | 1505 | 1493 | 1471 |
| West-Central | | 1519 | 1184 | 1240 | 1253 | 1262 | 1311 | 1279 | 1419 | 1368 | 1353 | 1316 |
| Southwest | | 1515 | 1110 | 1263 | 1278 | 1296 | 1351 | 1309 | 1635 | 1464 | 1432 | 1358 |
| Central | | 875 | 459 | 489 | 489 | 486 | 492 | 489 | 511 | 490 | 506 | 487 |
| *Total* | *6972* | *5351* | *4154* | *4438* | *4472* | *4506* | *4646* | *4541* | *5167* | *4827* | *4784* | *4632* |
| California - | | | | | | | | | | | | |
| *Total* | *2216* | *2261* | *1379* | *1463* | *1464* | *1440* | *1462* | *1464* | *1486* | *1527* | *1447* | *1520* |
| All States - | | | | | | | | | | | | |
| *TOTAL* | *14849* | *12181* | *10125* | *10545* | *10582* | *10583* | *10766* | *10654* | *11312* | *11034* | *10887* | ***10802*** |

[1] The study area includes the counties that fall , whole or in part, within the range of the northern spotted owl.

**Table VI-16.** Historic and projected employment in timber industries in next decade, by subregion in the study area and alternative.[1]

| | Actual | Estimated | Alternative | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State/Region | 1990 | 1992 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | ----------thousand jobs-------------- | | | | | | | | | |
| Washington - | | | | | | | | | | | | |
| Olympic Peninsula | 13.9 | | 12.0 | 12.1 | 12.1 | 12.0 | 12.1 | 12.0 | 12.0 | 12.0 | 12.1 | 12.0 |
| Puget Sound | 25.7 | | 20.9 | 21.0 | 21.0 | 21.0 | 20.9 | 21.0 | 20.9 | 21.1 | 21.0 | 21.0 |
| Lower Columbia | 14.1 | | 12.7 | 12.8 | 12.8 | 12.8 | 12. | 12.8 | 12.9 | 12.9 | 12.9 | 12.8 |
| Central | 4.2 | | 4.0 | 4.2 | 4.3 | 4.2 | 4.3 | 4.3 | 4.4 | 4.5 | 4.3 | 4.4 |
| *Total* | *57.9* | *51.3* | *49.7* | *50.1* | *50.1* | *50.0* | *50.2* | *50.1* | *50.3* | *50.5* | *50.2* | *50.2* |
| Oregon - | | | | | | | | | | | | |
| Northwest | 21.9 | | 20.4 | 20.8 | 20.9 | 21.0 | 21.3 | 21.0 | 22.3 | 21.4 | 21.3 | 21.1 |
| West-Central | 20.9 | | 14.3 | 14.8 | 14.9 | 15.0 | 15.4 | 15.1 | 16.4 | 16.0 | 15.9 | 15.5 |
| Southwest | 21.4 | | 11.0 | 12.3 | 12.5 | 12.6 | 13.1 | 12.8 | 15.7 | 14.2 | 13.9 | 13.2 |
| Central | 8.9 | | 7.5 | 8.0 | 8.0 | 7.9 | 8.1 | 8.0 | 8.4 | 8.0 | 8.2 | 8.0 |
| *Total* | *73.1* | *62.8* | *53.2* | *56.0* | *56.3* | *56.6* | *57.9* | *56.9* | *62.8* | *59.5* | *59.3* | *57.7* |
| California - | | | | | | | | | | | | |
| *Total* | *13.9* | *11.3* | *10.0* | *10.5* | *10.5* | *10.4* | *10.5* | *10.5* | *10.6* | *10.9* | *10.3* | *10.8* |
| All States - | | | | | | | | | | | | |
| ***TOTAL*** | ***144.9*** | ***125.4*** | ***112.9*** | ***116.6*** | ***116.9*** | ***117.0*** | ***118.6*** | ***117.5*** | ***123.7*** | ***120.9*** | ***119.8*** | ***118.7*** |

[1] Includes self-employed in all solid wood products and pulp and paper sectors. Wage and salary employment is approximately 7.5 percent less than total employment. The study area includes the counties that fall, whole or in part, within the range of the northern spotted owl.

The alternatives presented in this draft SEIS would have the greatest effect upon the timber industry sector. In addition to the workers displaced, there would be "indirect effects" caused by fluctuating business expenditures in the region and "induced effects" caused by changes in personal expenditures in the region. These ripple effects tend to increase the ramifications of job gains or losses in communities or regions. There is roughly 1 job lost outside the timber industry for every job affected within the timber industry.

Timber based employment would decline under all alternatives considered as a result of reduced harvests. The subregions that are characterized as heavily timber-dependent are apt to see the most severe impacts. While service employment in forestry appears to also be faced with job declines, these could be offset through investments in reforestation, timber stand improvement, monitoring, inventory, and restoration activities.

Some employment gains could be made in recreation and tourism, as well as in special forest products. It may, however, be difficult to absorb displaced loggers and mill workers into these fields due to skill considerations and geographic locations.

In the long run, the alternatives may provide an increased supply to commercial fisheries, but in light of the current issues and the potential over-capacity of the industry, these gains may not be substantial. Restoration of salmon and trout runs, however, could have positive effects on coastal recreation.

Mineral activities may have long-term costs or benefits of great significance to the region and to the nation.

While the net impact of implementation of any of the alternatives is apt to be displacement of natural resource-based jobs, the economy of the region as a whole is predicted to continue to grow. Rural communities will lose jobs and decline while the more developed areas continue to expand.

## GOVERNMENT REVENUES

### Affected Environment

Throughout the range of the northern spotted owl, Federal timber harvest has been an important source of revenue in terms of returns to local governments. Studies from western Oregon show that county governments derived on average 23 percent of their funds from timber receipts in 1988, while schools derived 2 percent of their funds from timber receipts. Because schools represent the vast majority of local government expenditures in Oregon, the sum total of local government tax base reliance was 7 percent. Southwestern Oregon counties are even more highly timber dependent: 55 percent of county funds, 4 percent of school funds, and 20 percent of aggregate local funds were derived from Federal timber harvest receipts in 1988. Currently, the Federal government shares 25 percent of the gross receipts from National Forest timber sales and 50 percent of the gross receipts from O&C lands (BLM and National Forest).

### Environmental Consequences

Under current policies, declines in Federal timber harvest will reduce Federal receipts to counties. While prices will increase, they will not offset the declines in revenues to Federal and local governments (Table VI-19). The Federal receipts noted in Table VI-19 are not indicative of returns to the Federal treasury, as there are administrative costs of approximately 30 percent of gross sales value. Both the Federal treasury and the local governments will see reduced revenues.

**Table VI-19.** Historic average and projected annual federal timber receipts, by subregion and option (by fiscal year).[1]

| | Average | Alternative | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| State/Region | 1990-1992 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | ---------- million dollars ---------- | | | | | | | | | | |
| **Washington - Owl Region** | | | | | | | | | | | |
| Gross Receipts | n/a | 14.2 | 42.4 | 45.4 | 41.7 | 57.9 | 51.5 | 85.9 | 77.3 | 62.9 | 60.1 |
| Local Gov't Share | 34.1 | 3.5 | 10.6 | 11.4 | 10.4 | 14.5 | 12.9 | 21.5 | 19.3 | 15.7 | 15.0 |
| Federal Share | n/a | 10.6 | 31.8 | 34.1 | 31.3 | 43.4 | 38.6 | 64.4 | 58.0 | 47.2 | 45.1 |
| **Oregon - Owl Region** | | | | | | | | | | | |
| **National Forests** | | | | | | | | | | | |
| Gross Receipts | n/a | 28.9 | 86.2 | 95.9 | 107.6 | 144.1 | 115.2 | 240.6 | 167.2 | 158.2 | 132.7 |
| Local Gov't Share | 107.7 | 7.2 | 21.6 | 24.0 | 26.9 | 36.0 | 28.8 | 60.1 | 41.8 | 39.5 | 33.2 |
| Federal Share | n/a | 21.7 | 64.7 | 71.9 | 80.7 | 108.0 | 86.4 | 180.4 | 125.4 | 118.7 | 99.5 |
| **Bureau of Land Management** | | | | | | | | | | | |
| Gross Receipts | n/a | 13.4 | 43.9 | 46.4 | 47.6 | 58.0 | 51.5 | 124.5 | 91.3 | 84.4 | 63.8 |
| Local Gov't Share | 131.1 | 6.7 | 21.9 | 23.1 | 23.7 | 28.9 | 25.7 | 62.0 | 45.5 | 42.0 | 31.8 |
| Federal Share | n/a | 6.7 | 22.0 | 23.3 | 23.9 | 29.1 | 25.8 | 62.5 | 45.8 | 42.4 | 32.0 |
| **California - Owl Region** | | | | | | | | | | | |
| Gross Receipts | n/a | 6.4 | 40.9 | 42.3 | 34.0 | 46.2 | 45.0 | 73.0 | 79.2 | 50.0 | 69.0 |
| Local Gov't Share | 21.4 | 1.6 | 10.2 | 10.6 | 8.5 | 11.6 | 11.2 | 18.2 | 19.8 | 12.5 | 17.3 |
| Federal Share | n/a | 4.8 | 30.7 | 31.7 | 25.5 | 34.7 | 33.7 | 54.7 | 59.4 | 37.5 | 51.8 |
| **All States - Owl Region** | | | | | | | | | | | |
| Gross Receipts | n/a | 62.9 | 213.4 | 230.0 | 230.9 | 306.2 | 263.2 | 524.0 | 415.0 | 355.5 | 325.6 |
| Local Gov't Share | 294.3 | 19.0 | 64.3 | 69.1 | 69.5 | 91.0 | 78.6 | 161.8 | 126.4 | 109.7 | 97.3 |
| Federal Share | n/a | 43.8 | 149.2 | 161.0 | 161.4 | 215.2 | 184.5 | 362.1 | 288.6 | 245.8 | 228.4 |

[1] Using current distribution formula without legislative safety net.

Due to the location of the greatest harvest reductions, and the nature of the revenue-sharing distribution formulas, southwestern Oregon is the most substantially impacted subregion. It should be noted that a legislative safety net has been safeguarding the communities from large scale reductions on a year-to-year basis. In 1993, the safety net payment for O&C lands guaranteed 85 percent of the average annual payment made from 1986 through 1990. Any reduction in these Federal receipts shared with the counties will correspondingly impact county governments and road funds due to the nature of the distribution formula.

### RURAL COMMUNITIES

**Affected Environment**

The study area for regional and community analysis for this document includes the counties that fall, in part or whole, within the range of the northern spotted owl. There are 25 counties in Washington, 24 in Oregon, and 8 in California in the study area. These counties include 347 communities (both incorporated and unincorporated areas) in Washington, 320 communities in Oregon, and 68 in California. Not all of these counties or communities were included in the analysis - the larger metropolitan counties (e.g., King, Pierce, Multnomah) and cities (Seattle and Portland) were excluded because of their concentration of residents and general lack of direct forest resource dependence.

The effects of the alternatives on rural communities are primarily those which flow directly and indirectly from changes in the regional and local economies. The preceding section on economic effects of the alternatives addresses the context of the changes, especially timber harvest levels, already occurring in rural communities and the changes expected by the alternatives. Effects on rural communities are estimated only for Alternatives 1, 3, and 7, as well as a 1985-87 timber harvest level scenario.

The social analysis focused on those rural counties and communities that are more timber and natural resources dependent. The analysis examined the effects on 30 communities in northern California, 81 in Oregon, and 108 in Washington for a total of 219 communities. The Assessment Team chose not to label specific, identifiable communities during the assessment process. Some labels, such as "risk" or "being at risk" have the potential to mobilize individuals and community leadership into action (e.g., woods products workers may start a small business in anticipation of layoffs and their children may show increased motivation for education; groups may respond with economic development efforts or participate more actively in influencing forest management policy decisions). However, labeling can also paralyze and demoralize community members, increase social disruption, and create indirect impacts on communities (e.g., red-lining of communities by banks). As a result, the Assessment Team did not identify communities by name or location within the FEMAT Report.

The community analysis entailed five efforts. First, a survey was sent to state extension agents to solicit background information and an overall rating of the adaptability in the face of change for the communities. Second, a report was prepared based on census data that summarized various demographic changes in the counties within the range of the northern spotted owl. Third, two workshops involving participants from a variety of government agencies and offices prepared detailed analyses of the relative ability of the communities to deal with changes imposed by the alternatives on a state-by-state basis. Fourth, a preliminary review of the particular relationships among the alternatives regarding Native American lands, rights, and uses was undertaken. Fifth, specialized papers were commissioned to provide detailed expert opinion and analysis in key areas. (For a presentation of the special difficulties Pacific Northwest rural communities face see Appendix A, Social Assessment of Options.)

## Consequences

Washington, Oregon, and California differ in the pattern, severity, and regional distribution of the effects of reduced timber harvest. The results of the analyses are discussed in terms of the severity and direction of the consequences, the communities' capacity to cope, and the resultant risk to the communities.

The three states differ in the timber industry's proportion of their economy, the structure and distribution of tax receipts to county and local governments, and distribution of Federal and private timberlands. This variability is reflected in the consequences associated with the alternatives presented in this Draft SEIS.

## Community Capacity

Community capacity involves the ability of residents, and community institutions, organizations, and leadership — formal and informal — to meet local needs and expectations. Community capacity involves a wide variety of factors that can be divided into three broad areas: (1) physical and financial infrastructure, (2) human capital, and (3) civic responsiveness.

The Assessment Team described strikingly similar patterns of consequences occurring in communities with similar types of capacity and intervening variables. Thus, although subregional variations can effect consequences, the main processes determining how communities are affected by changes in Federal forest policies is similar throughout the region. There is considerable variation in community capacity and consequences among communities.

Communities with moderately high or high capacity tend to be larger communities. Although examples exist of small communities with relatively high capacity, smaller communities tend to have limited infrastructure, lower levels of economic diversity, less active leadership, more dependence on nearby communities, and weaker links to centers of political and economic influence. These communities also are likely to have less control over resources and capital. As a result, small communities are more vulnerable to external change, such as shifts in forest management policies and their secondary effects.

Some regional patterns emerge directly from the data. The ratings define a region of lower capacity/negative consequences in the isolated interior Coast Range of Oregon and along the west slope of the Cascade Range. Two other groupings of low capacity/negative consequences occur in the central Olympic Peninsula and along the North Cascade Range.

Washington communities with lower capacity are likely to be smaller, highly dependent on the timber industry, and, like Oregon, beyond primary transportation corridors. Preliminary analysis of the community ratings in all three states indicates that only about 20 percent of low capacity communities lie within 10 miles of interstate highways, compared to nearly 60 percent of high capacity communities.

Coastal communities in all three states tend to have higher capacities and more positive consequences, due in large part to better developed tourism and more diversified economies. The two workshop panels indicated that communities surrounded by Federal lands (typically smaller and in isolated mountainous areas) are likely to have low capacity and more negative consequences regardless of the alternatives. Preliminary analysis of communities in all three states indicates a negative relationship between capacity and the closeness and density of surrounding Federal forest land.

Both workshop panels considered many attributes in common when rating community capacity. The factor most commonly mentioned was economic diversity, including the degree of timber dependence based on employment and availability of private timber resource. Local leadership and location were also cited as critical components of capacity. Other factors include a history of community-based improvement efforts, community cohesion and conflict, civic involvement, local control of resources, community attitude, cultural identity, population size, and income levels.

The workshop panels also emphasized both similar and different factors when assessing consequences. Specific consequences estimated under Alternatives 1, 3, and 7 generally depended on the participants' understanding of age-class distribution of forests across matrix lands, assumptions regarding the distances that timber sale bidders are willing to haul logs in a rapidly changing market, and assumptions about availability of timber on state and private lands as well as Federal lands outside the region.

Panels for each of the states differed in their interpretations of what alternatives meant for consequences to communities. California panelists considered present conditions to be similar to Alternative 3, whereas Oregon panelists equated Alternative 7 to current conditions. In Oregon, Alternative 1 and 3 were considered to improve fisheries and, hence, consequences in coastal and fishing communities. Washington panelists, however, felt that three years was not adequate to improve fisheries.

California panelists viewed the 1985-87 scenario differently than other state panels. Tending to see it as an alternative, they rated its consequences more negatively because they felt it included a harvest level that was not sustainable. In other states, panelists regarded the 1985-87 scenario more as a base or historic reference point against which to judge change. As an example, in about 25 percent of the California communities, the panelists saw positive consequences associated with Alternative 7 compared to Alternative 3, but saw generally negative consequences for communities facing a shift from Alternative 7 to the harvest levels of 1985-87. This pattern of rating occurred in less than 3 percent of the communities in the other two states.

Panelists in Washington elected to apply a "no effect" rating for a number of communities (about 20 percent) that they felt would not experience any effects from changes in Federal forest management. The California and Oregon groups did not use this label; they felt all communities would be affected in some manner and tended to give "even" ratings to communities lacking direct dependency on timber. The panelists who rated northern California communities considered a larger set of complex interactions affecting communities as a result of Federal forest management than did panelists in the other two states.

fall between those presented for Alternatives 3 and 7 because Alternative 9 is expected to produce a timber harvest level which is higher than Alternative 3 and lower than Alternative 7. As shown in Table VII-6, communities generally cluster in the range between low capacity and negative consequences and high capacity and moderately positive consequences for each alternative. These are called consequence ratings. Considering Alternative 7 and the 1985-87 scenario, and specifically as harvest levels from Federal lands increase, a greater number of communities have more positive consequence ratings.

By examining the variation in consequence ratings for individual communities among the alternatives, the relative sensitivity of communities to shifts in Federal timber availability becomes clearer. For example, some insensitivity to the alternatives is apparent even in the aggregate state ratings. For California, as compared to the other two states, the difference between average consequence ratings for Alternatives 1 and 7 are nearly twice as high - and are over three times as high for Alternatives 1 and 3. Although these state-level differences may be caused by a variety of factors, they do indicate an underlying variation in responsiveness to management changes and, specifically, to Federal harvest level changes (Table Vll-7).

**Table VII-7.** Predicted levels of consequences of management scenarios expressed as a percentage of communities of consequence level.

**Combined for Northern California, Oregon, and Washington**

| Management Scenario | *Negative* | *Medium Negative* | *Medium* | *Medium Positive* | *Positive* | *No Affect* |
|---|---|---|---|---|---|---|
| *OPTION 1* | *36%* | *22%* | *22%* | *7%* | *0%* | *10%* |
| *OPTION 3* | *24%* | *24%* | *36%* | *6%* | *0%* | *10%* |
| *OPTION 7* | *12%* | *22%* | *50%* | *5%* | *0%* | *10%* |
| *85-87* | *0%* | *5%* | *33%* | *38%* | *15%* | *10%* |

In some of the heavily dependent communities, consequence ratings increase several points (that is, become more positive) moving from Alternative 1 to the 1985-87 scenario. Ratings for other communities are unchanged across the alternatives, indicating either a balance of positive and negative affects, or communities less affected by Federal forest policy. Still other communities have ratings that are negatively related to increases in timber harvest levels. As seen in Figure VII-2, changes in consequence rating range from negative to positive when moving from Alternative 1 to 3 to 7 to the 1985-87 scenario.

As reported in the Economic Effects section of this Draft SEIS, major reductions have already occurred in timber harvest levels in the planning area (from a peak of about 4.5 billion board feet per year between 1980 and 1989 to only 2.4 billion board feet per year from 1990 to 1992). Because the ASQs (allowable sale quantities) in Alternatives 1 through 10 are far below recent averages, the variation in ASQ among the alternatives will lead to few differences in effects on communities.

These data suggest that some of the adverse effects associated with declining harvest levels from Federal lands have already occurred. The timber harvest levels currently are relatively high due to sales under contract from the late 1980's. The full effects on employment will be felt by 1994 as the available timber from Federal forest lands is reduced. It may be that there is too little variation in the harvest levels across the alternatives to create a meaningful difference in social effects for the future, given those that have already occurred, and the extent to which communities have already adapted.

**Table VII-6.** Relationship between community capacity and consequences.

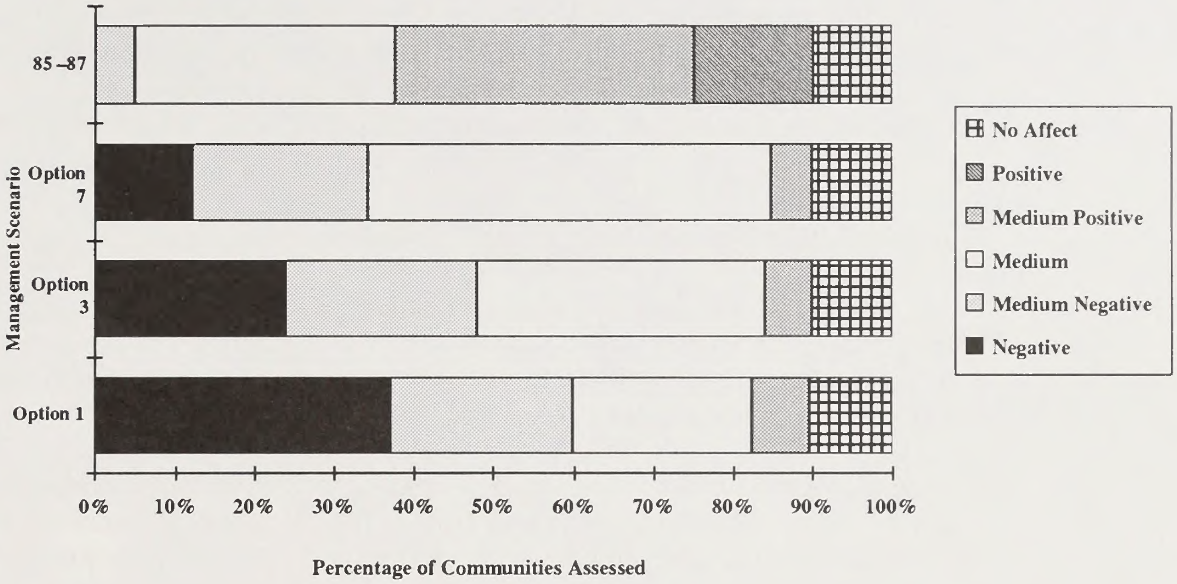
| **Option 1** | **Consequences to Communities (%)** | | | | |
|---|---|---|---|---|---|
| Capacity | *Negative* | *Moderately Negative* | *Even* | *Moderately Positive* | *Positive* |
| *Low* | *12* | *3* | *0* | *1* | *0* |
| *Medium Low* | *13* | *5* | *3* | *2* | *1* |
| *Medium* | *8* | *8* | *7* | *1* | *0* |
| *Medium High* | *7* | *4* | *4* | *3* | *0* |
| *High* | *2* | *4* | *9* | *4* | *0* |

| **Option 3** | **Consequences to Communities (%)** | | | | |
|---|---|---|---|---|---|
| Capacity | *Negative* | *Moderately Negative* | *Even* | *Moderately Positive* | *Positive* |
| *Low* | *7* | *5* | *1* | *1* | *0* |
| *Medium Low* | *9* | *6* | *6* | *2* | *0* |
| *Medium* | *4* | *10* | *10* | *1* | *0* |
| *Medium High* | *6* | *3* | *9* | *1* | *0* |
| *High* | *1* | *3* | *12* | *3* | *0* |

| **Option 7** | **Consequences to Communities (%)** | | | | |
|---|---|---|---|---|---|
| Capacity | *Negative* | *Moderately Negative* | *Even* | *Moderately Positive* | *Positive* |
| *Low* | *4* | *6* | *3* | *1* | *0* |
| *Medium Low* | *6* | *6* | *10* | *1* | *0* |
| *Medium* | *2* | *6* | *15* | *2* | *0* |
| *Medium High* | *1* | *5* | *11* | *1* | *0* |
| *High* | *1* | *2* | *16* | *1* | *0* |

| **1985-87 Scenario** | **Consequences to Communities (%)** | | | | |
|---|---|---|---|---|---|
| Capacity | *Negative* | *Moderately Negative* | *Even* | *Moderately Positive* | *Positive* |
| *Low* | *0* | *2* | *6* | *4* | *4* |
| *Medium Low* | *0* | *1* | *12* | *9* | *2* |
| *Medium* | *0* | *0* | *8* | *10* | *6* |
| *Medium High* | *0* | *1* | *4* | *10* | *3* |
| *High* | *0* | *2* | *4* | *11* | *2* |

**Figure VII-2.** Predicted consequences of four Federal land management scenarios on communities in northern California, western Oregon, and western Washington.



## Rural Communities at Risk

For the purposes of this assessment, risk is a function of the relationship between community capacity and the consequences associated with the alternatives. Communities with combinations of low capacity and negative consequences from the alternatives illustrate that the interaction of capacity and consequences from the alternatives are "most at risk"; those with high capacity and positive consequences are "least at risk." Using this definition of risk, Alternatives 1, 3, and 7 would result in about one-third of the 167 surveyed communities falling in the "most at risk" category. In all three alternatives, however, the changes are great compared to those for the 1985-87 harvest level scenario in which only 3 percent of the communities were so ranked.

Not surprisingly, the majority of the communities "most at risk" in Alternatives 1, 3, and 7 appear to be those highly dependent on the timber industry and on Federal forest lands as the source for much of their timber supply. Workshop panelists predicted that Alternatives 1, 3, and 7 would likely lead to additional mill closures and reduced forest related employment, and that the economic and social infrastructure would suffer.

The "most at risk" communities differ from others in significant ways. These communities are smaller (average population 3,000, with most under 6,500), and they are located in counties with low population density. Workshop panelists judged that isolated communities were more likely to experience negative consequences with Alternatives 1, 3, and to a lesser degree 7, because they have few options available locally or in nearby communities, and because of limited access to capital, transportation links, and other resources. In many "at risk" communities, there also is a somewhat higher proportion of income from public assistance. This was particularly the case in California where 5 percent of income was so derived, compared to an average of 2.5 percent in other "at risk" communities and 1.9 percent in all subregions.

Communities that are small, isolated, lack economic diversity, and have low leadership capacity are more likely to be "at risk" than others. These communities may find it difficult to mobilize and respond to changing conditions which may affect a variety of groups. These communities are likely to experience unemployment, increased poverty, and social disruption in the absence of assistance.

## ECONOMIC AND COMMUNITY MITIGATION

The Clinton Administration has developed an integrated program to improve economic conditions in timber-dependent communities that will be affected by the implementation of any ecosystem management plan. The program addresses both immediate and intermediate needs, and it has four elements:

1. Assistance to workers and families — increased availability of monies from the discretionary national reserve account under Title III of the Job Training Partnership Act (JTPA) for job search assistance, retraining, and relocation. The program also calls for a coordinated effort to expand conservation corps activities for young people in the rural Pacific Northwest.

2. Assistance to firms and industries — increased funding for successful business grant-making and lending programs (currently administered by the Department of Agriculture), expanded technical assistance (through the Department of Commerce), and adjustments in Federal procurement practices. The program also calls for increasing the supply of timber to the secondary processing sector of the Pacific Northwest timber industry and for eliminating tax incentives for log exports.

3. Assistance to communities — stabilization of fiscal assistance to Pacific Northwest counties, strengthening of community capacity to plan for economic development and diversification, and improving the infrastructure necessary for such development.

4. New investments in ecosystems — investments in watershed maintenance, ecosystem restoration and research, environmental monitoring, and forest stewardship that will improve the condition of the region's ecosystem, create jobs in timber-dependent areas, improve water quality, and increase salmon stocks to avoid salmon listings and improve commercial fishing.

The Clinton Administration has requested that Congress provide a total of $1.2 billion ($333 million of which is new money) in fiscal year 1994 for a number of programs in the Departments of Commerce, Agriculture, Labor, Interior, Environmental Protection Agency, and the Small Business Administration.

## NATIVE AMERICAN PEOPLES AND CULTURES

### Affected Environment

Native Americans have occupied the Pacific Northwest region for perhaps 35,000 years. There are 25 federally recognized tribes in California and 36 in Oregon and Washington that are located in and have cultural interest within the range of the northern spotted owl (see Appendix A). Of these, 25 have treaties and 10 have Executive Orders that affirm certain rights—both on and off reservations—for water, gathering, hunting, fishing (including the right to erect stations and temporary housing for curing fish), and other activities and resources (see Appendix D for a description of activities on tribal lands to inventory northern spotted owls).

Native Americans were active managers of the land. They used fire and otherwise managed the land to create and maintain specific landscapes. Harvest strategies and techniques were governed by a complex system of social, political, and cosmological mechanisms that served to regulate and distribute resources in a manner which ensured perpetuation of, and access to, culturally important plants and animals. Recent research indicates that certain plants may need to be managed in a traditional manner, including the use of prescribed fire, to maintain their vigor and distribution within the landscape (Blackburn and Anderson 1993).

### Consequences

Given both traditional and contemporary links between Native Americans and forests, it is clear that tribal members depend on public lands and resources for employment, subsistence, and cultural identity. Implementation of standards and guidelines would affect many of the practices and activities undertaken by Native Americans. For example, standards and guidelines that prohibit or discourage the collection of certain plant materials or trees could affect tribal rights and cultural subsistence practices. However, there are great variations in the uses of natural resources and sites on Federal forest land by the various tribes.

Habitat protection measures, such as controls on the use of fire, could also have effects if these controls occur within traditional gathering areas (e.g., for grasses and huckleberries) that need to be burned. There appears to be little difference in consequences associated with Alternatives 1 and 3. Alternative 7 would have a tendency to disturb sites which are meaningful to Native Americans. The degree of disturbance to vegetation, land, and wildlife is reduced under Alternatives 2, 4, 5, 6, 9 and 10, as compared to Alternatives 7 and 8, but higher than Alternatives 1 and 3. These alternatives also provide protection to riparian and other areas which equates as a beneficial effect on traditional cultural sites and areas.

# OTHER ENVIRONMENTAL EFFECTS

The environmental impact statements which are supplemented by this SEIS disclosed consequences to a number of environmental components, resources, and human uses that have not been addressed in this chapter in this Draft SEIS. They include:

Global Climate
Soils
Land Adjustments and Special Use Permits
Forest Roads
Special Areas
Wild and Scenic Rivers
Cultural Resources
Minorities, Women, and Civil Rights
Rural Interface Areas

An essential characteristic of all 10 action alternatives in this Draft SEIS is that they would permit significantly fewer ground-disturbing activities than the preferred or selected alternatives in those earlier EISs. Thus, those elements which benefit from little human interference will have environmental consequences less severe than disclosed in the supplemented EISs. Those elements which are themselves management activities, which benefit from management or from early seral stages, or reflect timber-dependent or overall employment, will experience more detrimental impacts than disclosed for the preferred and selected alternatives in those earlier EISs.

## Adverse and Long-Term Consequences

The Council on Environmental Quality regulations require that this discussion include "...any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented" (40 CFR 1502.16). The proposal is the preferred alternative, Alternative 9.

### ADVERSE CONSEQUENCES

The adverse consequences which could not be avoided if the preferred alternative was implemented have been presented in the earlier parts of this chapter. Because the preferred alternative adds late-successional and old-growth reserves and riparian reserves to existing management direction, adverse consequences include the loss of jobs and income, and the threat to the economic vitality of some timber-dependent communities.

Any reduction in habitat for late-successional and old-growth related species which would occur in the implementation of Alternative 9 would proceed only if site-specific environmental analysis and consultation found management activities consistent with this and other management direction.

## SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The use of natural resources for long-term sustained yield is at the basis of management and direction for the Forest Service and the Bureau of Land Management. The uses of resources under the standards and guidelines of the preferred alternative and current plans will result in no long-term loss in productivity of forest soils and other components necessary for a healthy forest environment.

## IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS

Implementation of projects in conformance with the preferred alternative would result in some loss of habitat for late-successional and old-growth related species in areas harvested for the period of time needed for it to grow again—a commitment of over a century. Some old-growth forest stands would be harvested under the preferred alternative. These areas will likely never again exhibit the intrinsic ecological and human values they now provide.

If the preferred alternative is implemented, land committed primarily to management for late-successional and old-growth related species would not provide tree growth at the rate it would were stands harvested and regenerated; this loss of growth is not retrievable. Some timber-dependent communities and enterprises adversely impacted by management under the preferred alternative are not likely to survive.

# LIST OF PREPARERS

## MEMBERS OF THE FOREST ECOSYSTEM MANAGEMENT ASSESSMENT TEAM

This Draft SEIS is adapted almost entirely from the work of the Forest Ecosystem Management Assessment Team and their report *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment*, which comprises Appendix A of this document. Literally, hundreds of people contributed to the Assessment Team's task. A complete list of the members of the Forest Ecosystem Management Assessment Team, as well as significant contributors, is included in Appendix A.

## MEMBERS OF THE INTERDISCIPLINARY TEAM

The following is a list of contributors to this supplemental environmental impact statement. Numerous others contributed to the completion of this document through their assistance in support functions and/or by assuming duties of coworkers who were deeply involved in this effort. Their help is greatly appreciated.

**Robert T. Jacobs** - *Interagency Team Leader.* Bob holds a B.S. and M.S. in Forest Management and has completed post-graduate work in resource economics at Michigan State University. He has 22 years of Federal service, 19 of them with the Forest Service. Currently, he is Deputy Regional Forester for the Pacific Northwest Region of the Forest Service. Prior to taking this assignment, he held positions in Washington, D.C., Florida, Pennsylvania, Wisconsin, and Michigan.

**Neil B. Armantrout** - *Aquatic/Riparian Specialist.* Neil has a Ph.D. in Fisheries and is currently the District Fisheries Biologist at BLM's Eugene District, and is a part time Research Advisor for the Fish and Wildlife Service. He specializes in aquatic habitat inventory, evaluation and planning, as well as ecosystem and biodiversity research and planning. He has held previous positions with the U.S. Fish and Wildlife Service, the Forest Service, and Washington Department of Fisheries.

**James H. Benson** - *Silviculturist.* Jim has been with the Forest Service for 25 years and is currently the Forest Silviculturist for the Klamath National Forest in Yreka, California. He is a certified silviculturist in the Pacific Southwest Region of the Forest Service and holds a B.S. in Forest Management from the University of California, Berkeley.

**Kenneth E. Denton** - *Implementation Specialist.* Ken also served as the Silviculturist and Timber Management Specialist for the Forest Service's Draft and Final Environmental Impact Statements for the Northern Spotted Owl. He has worked for the Forest Service for 23 years. He haso worked in silviculture and forest planning on five National Forests in California, Idaho, and Oregon, most recently serving as a District Ranger, then Regional Silviculturist in the Pacific Southwest Region. He holds a B.S. in Natural Resources with an emphasis in forestry from California State University, Humboldt, and is a certified silviculturist.

**Wayne Elson** - *Environmental Protection Specialist.* Wayne has worked for the Environmental Protection Agency for 18 years as an Environmental Protection Specialist. He holds a B.S. in Geography-Planning from Northern Michigan University. Wayne specializes in reviewing environmental impact statements also has extensive experience in water quality management.

**Elizabeth Holmes Gaar** - *Fisheries Biologist.* Elizabeth holds a B.S. in Fishery Science from Oregon State University and a J.D. from Northwestern School of Law, Lewis and Clark College. She specializes in fishery biology and the Endangered Species Act. She is currently Chief of the Endangered Species Branch of the National Marine Fisheries Service, Northwest Region. Previous positions include Assistant Chief, Habitat Conservation Branch, also with the NMFS Northwest Region; and District Biologist on the Siuslaw and Mt. Hood National Forests of the Forest Service.

**Maria Gregory** - *Writer/Editor.* Prior to joining the Interagency SEIS Team, Maria worked with the Northern Spotted Owl Draft SEIS Team and the Scientific Analysis Team. She has been with the Forest Service for 8 years in planning, recreation, and public affairs. Her areas of expertise are document production, environmental education, and media relations. Maria has worked in Alaska, New Mexico, Colorado, California, Washington, and Oregon.

**Philip J. Hall** - *Planning and Environmental Coordination.* Phil has spent the last 17 years in a variety of forest and engineering related positions on both the Medford and Roseburg Districts of the Bureau of Land Management. He brings to the SEIS Team a broad understanding and familiarity of BLM programs and plans, including the western Oregon Draft Resource Management Plans and Environmental Impact Statements. Phil holds a B.S. in Forestry and a B.S. in Conservation from North Carolina State University.

**Chris A. Hamilton** - *Timber Operations Specialist.* Chris' specialties include timber sale planning and harvest scheduling. He has been with the Bureau of Land Management's Coos Bay District for 15 years and is currently the Information Resource Manager. He has extensive experience in timber sale planning, harvest scheduling, and Geographic Information Systems (GIS). He holds a B.S. in Forest Management from Clemson University.

**J. Sharon Heywood** - *Public Affairs Specialist.* Sharon holds a B.S. in Mathematics from the College of William and Mary and a J.D. from George Washington University. In her 13 years with the Forest Service Sharon has worked as a Staff Assistant in National Forest Systems with the Washington, D.C. office, Deputy Director of Planning for the Pacific Northwest Region, and is currently the Deputy Forest Supervisor for the Gifford Pinchot National Forest in Vancouver, WA. She specializes in land management planning.

**Mauragrace Healey** - *Writer/Editor*. Mauragrace also served as the Writer/Editor for the Draft and Final Environmental Impact Statements for the Northern Spotted Owl and the Scientific Analysis Team Report. She has worked for the Forest Service for 13 years in public affairs, forest planning and silviculture. Her specialties include community relations, and document preparation and design. She holds a B.A. in French and a B.S. in Film and Television Production. She has completed graduate work in writing and environmental education.

**J. Randal Hickenbottom** - *Wildlife Biologist.* Randy also served on the Forest Service's Northern Spotted Owl SEIS Team as wildlife biologist. He is currently the Budget Coordinator for the Fish and Wildlife Unit at the Pacific Northwest Regional Office. He has worked for the Forest Service for 13 years. Prior to working in the Regional Office, he served as a District Resource Assistant, District Biologist, and Zone Biologist on the Fremont National Forest. He has worked on three National Forests in Oregon and Arizona and holds a B.S. in Natural Resources with an emphasis in wildlife ecology from the University of Arizona.

**Arnold G. Holden** - *Assistant Team Leader.* Arnie served as the Assistant Team Leader for the Draft and Final Environmental Impact Statements for the Northern Spotted Owl. Arnie has worked as a sociologist in planning and environmental coordination for land management agencies for the last 16 years, 13 of them with the Forest Service in the Pacific Northwest Regional Office and in Washington, D.C. He holds a Ph.D. in Sociology from Michigan State University, and his areas of expertise are the National Environmental Policy Act and social impact assessment.

**Jacob J. Hoogland** - *Interagency Reviewer.* Jake is Chief of the Environmental Quality Division of the National Park Service. He specializes in environmental Planning and has a law degree from the University of Utah College of Law. In his 14 years with the National Park Service Jake has held a variety of positions including Ranger for the Mesa Verde National Park, and Environmental Compliance Specialist with the Denver Service Center.

**Kathy Johnson** - *Planner.* During her 14 years with the Forest Service Kathy has held several positions in the Pacific Northwest Region including District Wildlife Biologist, Forest Planning Biologist, Regional Wildlife Biologist and District Ranger. Prior to her current position, Kathy served as the Endangered Species Program Manager and Legislative Fellow in the Washington, D.C. Office. Kathy holds a B.A. in Biology from Central Washington State College with expertise in endangered species and forest planning at the District, Forest, Regional and National level.

**Roger W. Monthey** - *Terrestrial Biologist.* Roger specializes in terrestrial biology and, as a wildlife biologist with the Salem District of the BLM, has extensive experience as a member of Resource Management Planning Teams. He holds a Ph.D. in Forest Resources from the University of Maine at Orono and has taught biology at two community colleges, as well as Antioch University in Seattle, WA. Roger also spent two years with the Oregon Department of Fish and Wildlife as a member of the Governor's Forest Planning Team.

**Catherine (Cay) Ogden** - *Wildlife Biologist.* In the last 13 years Cay has worked as a biologist for the Bureau of Land Management, Forest Service, Bureau of Indian Affairs, and the Fish and Wildlife Service. Her specialties include northern spotted owl recovery issues, the Endangered Species Act, and forest ecology. She is working on a M.S. in Wildlife Management from the University of Idaho, and is currently the Spotted Owl Recovery Specialist for the Fish and Wildlife Service's Regional Office in Portland, Oregon.

**Kadonna Pennell** - *Administrative Officer.* For the last 8 years Kay has worked as the Administrative Assistant with the Forest Service in the Pacific Northwest Regional Office. Kay has worked with a variety of special teams including the Interagency Spotted Owl Committee, Gang of Four, the Forest Service's Blue Mountain Restoration Panel, Northern Spotted Owl EIS Team, and the Scientific Analysis Team. She specializes in administrative systems and procedures for special projects.

**Cynthia L. Ricks** - *Forest Resource Geologist.* Cindy holds two degrees in Geology, a B.S. from UCLA, and an M.S. from Oregon State University. She has worked on the Siskiyou National Forest as a Resource Geologist since 1984. Prior to this assignment she was an Engineering Geologist with the U.S. Army Corps of Engineers, and also held a graduate student appointment at Redwood National Park studying flood history and sedimentation. Cindy specializes in forest geomorphology and watershed analysis.

**John Singlaub** - *Assistant Team Leader.* John's specialties include project management, planning, National Environmental Policy Act, and Geographic Information Systems (GIS) applications. He holds a Master of Planning (M.P.) in Environmental and Land Use Planning from the University of Virginia. John has been with the Bureau of Land Management for 14 years, most recently as the Special Projects Manager for the New Mexico State Office.

**Peter D.A. Teensma** - *Forest Ecologist.* Peter holds a Ph.D. in Geography (Biogeography) from the University of Oregon and specializes in the role of fire in western Oregon forest ecosystems. He is currently the Fire Ecologist with the Oregon State Office of the Bureau of Land Management and has held other positions in fire management and ecosystem modeling with the BLM and Forest Service since 1985.

**Gerald W. Williams** - *Sociologist.* Jerry holds a Ph.D. in Sociology from Washington State University and has been a Sociologist with the Forest Service since 1979. He worked in long-range planning for the Umpqua and Willamette National Forests for 14 years. In January 1993, he became the Forest Service's Regional Sociologist for Planning and Environmental Affairs. Recently Jerry was involved with the Blue Mountains Restoration Project in 1992, the Pacific Yew EIS in 1992-1993, and the Ecosystem Management Assessment Team in 1993.

# SPECIAL ACKNOWLEDGEMENTS

*The Interdisciplinary Team would also like to recognize the significant contributions of the following people:*

Sharon Alverts
David Bray
John Gant
Michael Hamel
Virginia L. Hokkanen
Tim Jacobsson
Bonnie Jakubos
Cliff McClelland
Theresia A. Munis
Marilyn A. Peters
Kristi S. Swisher

# DISTRIBUTION LIST

An inquiry letter to receive this Draft Supplemental Environmental Impact Statement was mailed to individuals and organizations from mailing lists developed by the Forest Service Draft Supplement to the Environmental Impact Statement on Management for the Northern Spotted owl in the National Forests, the Bureau of Land Management Resource Management Plans, and the Fish and Wildlife Service's Final Draft Recovery plan.

The distribution list below represents all those individual and organizations who requested and were sent copies of either or both the Draft Supplement Environmental Impact Statement and Appendix A, the Forest Ecosystem Management Assessment Team Report.

## ELECTED OFFICALS

CONGRESSMAN ROBERT F SMITH
CURRY COUNTY COMMISSIONER
HOUSE OF REPRESENTATIVES
OFFICE OF THE GOVERNOR
OR GOVERNOR'S TIMBER TEAM
PRINEVILLE DISTRICT OFFICE
REPRESENTATIVE MARIA CANTWELL
SENATE DEMOCRATIC CAUCUS
SENATOR RICHARD LUGAR
STATE SENATE DIST 16
US HOUSE OF REPRESENTATIVES
US REP PETER DEFAZIO
US SENATE
US SENATOR SLADE GORTON
WA ATTORNEY GENERALS OFFICE
WA GOVERNOR'S TIMBER TEAM
WA STATE HOUSE OF REPRESENTATIVES
WA STATE SENATE

## FEDERAL AGENCIES

AFCE E/CCR-S
AFPA
AMERICAN FARM BUREAU
AMERICAN RIVERS
APHIS ADC
ARMY
ARMY CORPS OF ENGINEERS
BLM-BAKER RESOURCE AREA
BLM- BURNS DISTRICT
BLM-COEUR D'ALENE DISTRICT
BLM-COLORADO STATE OFFICE
BLM-COOS BAY DISTRICT
BLM-DEPT OF THE INTERIOR
BLM-DILLON RESOURCE AREA
BLM-EASTERN STATES
BLM-KLAMATH FALLS DISTRICT
BLM-LAKEVIEW MULTIPLE USE ADVIS.
BLM-MEDFORD DISTRICT
BLM-OREGON STATE OFFICE
BLM-PHOENIX RESOURCE AREA
BLM-ROSEBURG DISTRICT
BLM-SALEM DISTRICT OFFICE
BLM-UKIAH DISTRICT OFFICE
BLM-UTAH STATE OFFICE
BLM-ARCATA RESOURCE AREA
BLM-CPD
BLM-EUGENE DISTRICT
BLM-REDDING RESOURC
BLM - BAKER RESOURCE AREA
BONNEVILLE POWER ADMIN-AJP
BUREAU OF INDIAN AFFAIRS
BUREAU OF MINES
BUREAU OF RECLAMATION
CHETCO RANGER DISTRICT
CHUGACH NATIONAL FOREST
CLEARWATER NATIONAL FOREST
CRATER LAKE NATIONAL PARK
DETROIT RANGER DISTRICT/PLANS DEPT
DIRKSON SENATE OFFICE BLDG
DIV CONSERVATION & WILDLIFE
DIVISION OF ENERGY & RESOURCES
ENVIRONMENTAL PROTECTION INFO CTR
ENVIRONMENTAL PROTECTION AGENCY
ENVR-CONSERVATION
EPA ENVIRONMENTAL RESEARCH LAB
EPIC/MAP RAP
FEDERAL HIGHWAY ADMINISTRATION
FISH & WILDLIFE SERVICE
FOREST SERVICE
FORESTRY SCIENCES LABORATORY
GEOLOGICAL SURVEY
GLEN CANYON ENVIRONMENTAL STUDIES
GOLD BEACH RANGER DISTRICT
HQ US ARMY GARRISON FORT PICKETT
IMPERIAL IRRIGATION DISTRICT
INTERAGENCY COMM OUTDOOR REC
INTERNAL REVENUE SERVICE
KLAMATH NATIONAL FOREST
LA GRANDE RANGER DIST
MANTECH ENVIRONMENTAL TECHNOLOGY
MAPLETON RANGER DISTRICT
MCKENZIE RANGER DIST/FOREST SERVICE
MENDOCINO NATIONAL FOREST
MOUNT RAINIER NATIONAL PARK
NW FORESTRY ASSN
NATIONAL ASSN OF STATE FORESTERS
NATIONAL MARINE FISHERIES SERVICE
NATIONAL PARK SERVICE
NATIONAL PARK SERVICE AIR
NATIONAL RESEARCH COUNCIL
NATIONAL WILDLIFE HEALTH RESOURCES
NAVY FORESTRY
NFC
NOAA
NORTH CASCADES NATIONAL PARK
OCHOCO NATIONAL FOREST
OKANOGAN NATIONAL FOREST
OREGON CAVES NATIONAL MONUMENT
PNW RESEARCH STATION
POSTAL SERVICE
PUBLIC LANDS COUNCIL
REDWOOD NATIONAL PARK
SENATE COMMITTEE ON AG NUTRITION
SENATE COMMITTEE ON ENVIRONMENT
SEQUOIA NATIONAL FOREST
SHASTA CASCADE WONDERLANDS
SIERRA NATIONAL FOREST

SISKIYOU NATIONAL FOREST
SISTERS RANGER DISTRICT
SIUSLAW NATIONAL FOREST
SIX RIVERS NATIONAL FOREST
SWEET HOME RANGER DISTRICT
SOIL CONSERVATION SERVICE
SOLEDUCK R D OLYMPIC NATIONAL FOREST
TAHOE NATIONAL FOREST
TARGHEE NATIONAL FOREST
TENNESSEE VALLEY AUTHORITY
TILLER RANGER DISTRICT
US ATTORNEYS OFFICE
USFS/LTBMU
WALLOWA WHITMAN NATIONAL FOREST
WILLAMETTE NATIONAL FOREST

## State, Provinces, County and City Governments

B C MINISTRY OF ENVIRONMENT
BC PARKS
BENTON COUNTY DEVELOPMENT DEPT
BLUE HERON ENVIRONMENTAL CENTER
BUTTE ENVIRONMENTAL COUNCIL
CA DEPT OF FISH & GAME
CA DEPT OF FORESTRY & FIRE PROTECTI
CA DEPT OF TRANS DIST 2
CA STATE LANDS COMMISSION
CA DEPT OF FORESTRY
CA FARM BUREAU FEDERAL
CA OUTDOORS
CA REGIONAL WQ CONTROL BD
CHAMBER OF COMMERCE
CITY OF BAY CITY
CITY OF CORVALLIS
CITY OF DETROIT
CITY OF KLAMATH FALLS
CITY OF MALIN
CITY OF MYRTLE CREEK
CITY OF MYRTLE POINT
CITY OF PATEROS
CITY OF PORTLAND WATER BUREAU
CITY OF SALEM
CITY OF SHERIDAN
CITY OF THE DALLES/WICKS WTR T PLNT
CITY OF TOLEDO
CITY OF WILLAMINA
CLACKAMAS CO PLANNING DIVISION
CLALLAM CO
COOS CO BOARD OF COMMISSIONERS
COOS CO OREGON PROJECT
COUNTY FORESTER
COUNTY OF KLAMATH
DALLAS CHAMBER OF COMMERCE
DEPT OF FISH & GAME
DEPT OF FORESTRY & FIRE PROTECTION
DEPT OF ECOLOGY
DEPT OF ENERGY MINES & RESOURCES
DEPT GEOL & MIN IND
DEPT OF NATURAL RESOURCES
DEPT OF PARKS & RECREATION
DIVISION OF STATE LANDS
DNR - SEPA CENTER
DOUGLAS CO BOARD OF COMMISSIONERS
DOUGLAS CO WATER RESOURCES SURVEY
DOUGLAS CO
DOUGLAS CO PLANNING DEPT
DOUGLAS CO PUBLIC WORKS
ECONOMIC DEV ASSOC OF SKAGIT COUNTY
EEL RIVER SALMON RESTORATION PROJ
EUREKA CHAMBER OF COMMERCE
FEATHER RIVER REC & PARK DISTRICT
FLORENCE AREA CHAMBER OF COMMERCE
FOREST CONSERVATION COUNCIL
FORESTRY CANADA ONTARIO REGION
GLENN CO BOARD OF SUPERVISORS
GOLD BEACH CHAMBER OF COMMERCE
GOVERNORS FOREST PLANNING TEAM
GRAYS HARBOR CO COMMISSIONERS
HOOD RIVER CO FORESTRY
HOOD RIVER CO PLAN DEPT
HORSETOWN CLEAR CREEK PRESERVE
HUMBOLDT CO PLANNING DEPT
I W A LOCAL 3-261/3-140
ILLINOIS VALLEY SOIL/WATER CNSRVTN
JACKSON CO COMMISSIONER
JACKSON CO PLANNING COMMISSION
JOSEPHIE CO PLANNING
JOSEPHINE CO BOARD OF COMM
JOSEPHINE CO LEGAL COUNSEL
KLAMATH CO
KLAMATH CO CHAMBER OF COMMERCE
KLAMATH CO PLANNING DEPT
KLICKITAT CO COMMISSIONERS
LAKE CO CHAMBER OF COMMERCE
LAKE CO
LAKESIDE CITY PLANNING COMMISSION
LAND CONSERVATION & DEVEL COM
LANE REGIONAL AIR POLLUTION AUTH
LASSEN CO BOARD OF SUPERVISORS
LINN CO
LOWER COLUMBIA ECON DEV COUNCIL
MARION CO PLANNING DIV
MEDFORD DISTRICT ADVISORY COUNCIL
MENDOCINO ENVIRONMENTAL CENTER
MID-COLUMBIA ECONOMIC DEV DIST
MID-WILLAMETTE VLY COUNCIL OF GVTS
N A W P A
NORTHCOAST ENVIRONMENTAL CENTER
O C Z M A
O S U EXTENSION
OFFICE OF THE GOVERNOR
OLYMPIA FORESTRY SCIENCES LAB
OR CO-OP WILDLIFE RESEARCH UNIT
OR COOPERATIVE WILDLIFE RES UNIT
OR DEPARTMENT OF FORESTRY
OR DEPT OF FISH & WILDLIFE
OR DEPARTMENT OF FORESTRY
OR DEPT OF GEOLOGY & MINERAL
OR DEPT OF TRANSPORTATION
OR DIV OF STATE LAND
OR DOT-ENVIRONMENTAL SECTION
OR ECONOMIC DEV DEPT
OR EMPLOYMENT DIVISION
OR EXTENSION OFFICE
OR INTL PORT OF COOS BAY
OR NATIONAL WILD TURKEY FED
OR NATURAL RESOURCES COUNCIL
OR PUBLIC LANDS ADVISORY COMM
OR TROUT/WATER WATCH OF OREGON
PACIFIC COUNTY E D C
PACIFIC STATE MARINE FISHERIES COMM
POLK CO COMMISSIONERS
POLK SOIL & WATER CONSERVATION DIST
PORTLAND WATER BUREAU
PUBLIC AFFAIRS/MILITARY DEPT WA ST
PUGET SOUND DISTRICT COUNCIL
RESEARCH & STATISTICS EMPLOYMENT DV
ROGUE VALLEY COUNCIL OF GOVTS
ROSEBURG AREA CHAMBER OF COMMERCE
SALEM PUBLIC WORKS DEPT
SCOTT VALLEY CHAMBER OF COMMERCE
SEATTLE WATER DEPT
SHASTA CO
SHASTA CO PLANNING DIVISION
SISK CO ADVISOR GRAZING COMM
SISKIYOU CO BOARD OF SUPERVISORS
SISKIYOU CO
SISKIYOU CO PLANNING DEPT
SISKIYOU PROJECT
SISKIYOU REGIONAL EDUCATION PROJECT
SISTERS FOREST PLANNING COMM
SKAWANIA CO
SOUTHERN OR LOG SCALING & GRADING B
SOUTHERN OREGON RESOURCE ALLIANCE
STATE MARINE BOARD
STATE REPRESENTATIVE
STEVENS CO COMMISSIONERS

TACOMA PUBLIC UTILITIES-WATER
TEHAMA CO BOARD OF SUPERVISORS
TILLAMOOK FOREST COUNCIL
TRINITY CO BOARD OF SUPERVISORS
TRINITY CO DEPT OF TRANSP
TRINITY CO PLANNING DEPT
TURNER PLANNING COMMISSION
UKIAH DISTRICT ADVISORY COUNCIL
UPPER RIDGE COUNCIL
WSEO
WA CO STOCK GROWERS/ORE CATTLEMENS
WA DEPT OF WILDLIFE
WA ENVIRONMENTAL COUNCIL SCLDF WS
WA STATE EMPLOYMENT SECURITY DEPT
WALDPORT RANGER DISTRICT
WALLOWA CO COURT
WA STATE DEPT OF TRANSPORTATION
WA STATE SENATE NATURAL RES COMM
WA CO DEPT/LAND USE & T
WA DEPT OF FISHERIES
WA ENVIRONMENTAL COUNCIL
WA FOREST PROTECTION
WA STATE ENERGY OFFICE
WA STATE LABON COUNCIL
WA TROUT
WEAVERVILLE-DOUGLAS CITY REC DIST
WESTERN LEGISLATIVE FORESTRY TSK FR
WILLAMALANE PARK & RECREATION DIST
YAMHILL SOIL & WATER CONS DIST

## BUSINESSES

ABC SIX RIVERS REALTY
ALRT CORP
AHRNS CHIROPRACTIC
ALLAN C WIRKKALA SR CONTRACTING
ALMANOR FOREST PRODUCTS
AMERICAN FOREST & PAPER ASSOCIATION
ARROWHEAD TIMBER CO
ARTHUR FARM
AVISON LUMBER CO
BPOE
BALD KNOB/MAZAMA DIV
BEAK CONSULTANTS INC
BEAR CREEK TREE FARMS
BEGINNINGS INC
BIO WEST CONSULTANTS
BIOSYSTEMS ANALYSIS INC
BLACKFOOT MINING CO
BLOCH LUMBER CO
BNA PUBLICATIONS
BOARDMAN SUHR CURRY & FIELD
BOGLE & GATES
BOHEMIA INC
BOISE CASCADE CORPORATION
BOISE CASCADE/ST HELENS
C&D LUMBER COMPANY
CCD BUSINESS DEVELOPMENT
CJM & ASSOCIATES DBA THINKING INC
CALIFORNIA COASTAL COMMISSION
CALTRANS
CARDINAL EMPLOYMENT SERVICES
CASCADE LOGGING INC
CASCADE PLANNING ASSOCIATES
CASCADE RIVER RUNNERS
CASCADE TIMBER CONSULTING INC
CEDAR SPRINGS
CELL TECH
CHAMPION INTERNATIONAL CORP
CHARLES SKINNER TRUCKING
CHEMEKETANS
CHESAPEAKE CARDIOVASCULAR ASSOC
CHINO LUMBER & HARDWARE
CLOVER LOGGING INC
COASTAL FOREST LANDS LTD
COGAN OWENS COGAN
COLDWELL-BANKER&HOLMAN REALTY INC
COLLINS PINE CO
COLUMBIA HELICOPTERS INC
COLUMBIA PLYWOOD
COMMUNITY BY DESIGN
COMMUNITY MEDICATION CONSULTANTS
COOKSLEY GEOPHYSICS INC
COOS COUNTY PLANNING DEPT
CORPS OF ENGINEERS
COTCHETT ILLSTON & PITRE
CROWELL & MORING
CROWN PACIFIC LTD
CUSTOM PROPERTIES
D THURESON INC
DAHLGREN LOGGING INC
DAHLSTROM LUMBER CO
DAMES & MOORE
DAW FOREST PRODUCTS CO
DECISION RESEARCH
DEERLICK SPRINGS RESORT
DEIXIS CONSULTANTS
DEJA INC
DIAMOND WOOD PRODUCTS INC
DILLS CREEK INC
DOLE COALWELL CLARK & WHITE P C
DOUGLAS ELECTRIC CO-OP
DR JOHNSON LUMBER CO
EA BESTLAND & ASSOCIATES
ECO NORTHWEST
EIP ASSOCIATES
EPIC
ESSI
EAGLE ROCK TIMBER CO
EASTERN OREGON MINING ASSOCIATION
EASTLICK TRUCKING
EBASCO ENVIRONMENTAL
EBEL & ASSOC INC
ECOPRO
ENOCH SKIRUM & SONS INC
ENVIRONMENTAL INVENTORY DATA
ERA NICHOLSON & ASSOCIATES
EROSION CONTROL INC
EVANS ENVIRONMENTAL CONSULTANTS
EVERGREEN PRODUCTS INC
FARM CREDIT
FELLER & ASSOCIATES
FENCL FARM & FOREST PRODUCTS
FENNIMORE CUTTING INC
FIR SPRINGS TREE FARM
FOREST MANAGEMENT INC
FOREST PRODUCTS FINANCE GROUP
FORESTRY & RANGE SCIENCES LAB
FORT VANCOUVER PLYWOOD
FORURIA
FOSS WHITTY LITTLEFIELD & MCDANIEL
FOX BENNETT & TURNER
FOX HOLLOW CORP
FRANK LUMBER CO INC
FRERES LUMBER CO
FRIESEN LUMBER CO
FRUIT GROWERS SUPPLY CO
FURMAN LUMBER INC
GMW LOGGING INC
GARDEN VALLEY REALTY
GENE WHITAKER INC
GEORGIA PACIFIC CORP
GIFFORD PINCHOT TASK FORCE
GILLEN LOGGING INC
GIMRE'S OF ROSEBURG INC
GIUSTINA RESOURCES
GOLD BAR ET AL MINING CO
GOLDEN REFORESTATION INC
GRANT LOGGING CO INC
GREATER ECOSYSTEM ALLIANCE
GREEN TREE PLANTATION INC & SORA
GREENWOOD ENGINEERING
GREINER INCORPORATED
GROVE CRUSHING CO
GUY BENNETT LUMBER CO
H2O POWR
HABITAT CREATIONS
HAMPTON TREE FARMS INC
HANEL LUMBER CO INC

HARZA NORTHWEST INC
HEADWATERS INC
HEATH LOGGING INC
HERITAGE RESOURCES
HERMANN BROS LOG & CONST INC
HERRIN REALTY
HI-RIDGE LUMBER CO
HORIZON HERBS
HUFFMAN & WRIGHT
HULL-OAKES LUMBER CO
HUMBOLDT BAY HARBOR DIST
HUNT POLE & LOG
IF RODGER & SONS
IMT AGENCIES INC
ITT RAYONIER INC
IWA - CANADA
IDAHO TIMBER CORP OF OREGON
ILLAHEE TREE FARM INC
INDEPENDENT LOGGING
INTERNATIONAL KNIFE & SAW INC
INTERNATIONAL PAPER CO
ITA & WIT ORVILLE BOONE TRUCKING
J&K LOGGING INC
J&S TRUCKING
JAMES RIVER CORP
JAPAN WOOD PRODUCTS INFO & RES CTR
JENSEN SECURITIES CO
JIM HARDIN TRUCKING
JOHN J KAIB MD PC
JOHNSON & KLOOS
JON L GOLLY INC
JONES & STOKES ASSOCIATES
KARNOPP PETERSEN NOTEBOOM ET AL
KAUFMAN & STEWART
KEN J COLLINS CO
KEVIN Q DAVIS ATTORNEY AT LAW
KEY LOG LTD
KNAPP LUMBER SALES INC
KNUDSON LOGGING INC
KNUTSON TOWBOAT CO
LD TRUCKING
LABAT ANDERSON INC
LAKE PLYWOOD
LAND LETTER
LANE ELECTRIC CO-OP
LANGELL VALLEY IRRIGATION
LAW OFFICES/RICHARD D SIEGEL
LILY GLEN HORSE TRIALS
LONE ROCK TIMBER CO
LONGVIEW FIBRE CO
LOUISIANA PACIFIC CORP
LOWER SPRINGS ACRES
LOWERY REALTY
LUCIDYNE TECHNOLOGIES
MAKAL FISHERIES MANAGEMENT
MANKE LUMBER CO INC
MARTIN MARIETTA ENERGY SYSTEMS INC
MASON BRUCE & GIRARD INC
MATTHEWS ASSOCIATES INC
MAYR BROS LOG CO INC
MCMINNVILLE WATER & LIGHT
MEADOW LAKE INCORPORATED
MEDFORD CORP
MENASHA CORPORATION
MENDOCINO 4 X 4
MINERS SUPPLY CO
MODOC LUMBER CO
MONETT LOGGING INC
MOORETOWN RANCHERIA
MOSS ADAMS
MT HOOD MEADOWS SKI AREA
MT PACIFIC CONSTRUCTION
MURRAY PACIFIC CORP
MUSSELMAN & ASSOC INC
NATURAL RESOURCES MANAGEMENT CORP
NATURAL SELECTION FORESTRY
NEW ENGLAND NATURAL RESOURCES CTR
NIEMI FORESTRY
NOBLE & BITTNER PLUG CO
NORMAN BARNES & CO INC
NORTH COAST ENVIRONMENTAL
NORTHWEST ENVIRONMENTAL CENTER
NORTHWEST FORESTRY ASSOCIATION
NORTHWEST MINING ASSOCIATION
NORTHWEST PUBLIC AFFAIRS NETWORK
NOYES VALLEY CATTLE CO
NW INDEPENDENT FORESTMANUFACTURERS
OCHOCO LUMBER CO
OFF-ROAD ADVERTISER
OJI PAPER CO LTD
OLYMPIC CASCADE TIMBER INC
OLYMPIC CENTRE
OREGON BIRDS
OREGON RAPTOR CENTER
OREM & SON INC
P&M CEDAR
PFE & ASSOC
PIC TECHNOLOGIES INC
PACIFIC FIBRE PRODUCTS INC
PACIFIC FISHERIES ENHANCEMENT
PACIFIC GAS & ELECTRIC CO
PACIFIC MERIDIAN RESOURCES
PACIFIC POWER & LIGHT CO
PACIFIC RIM ENVIROMENTAL INC
PACIFIC RIM TRADE ASSOCIATION
PACIFIC WOOD FUELS CO
PACIFICORP
PALO ALTO VA MEDICAL CENTER
PAN OCEAN SHIPPING CO
PARK PLACE REAL ESTATE
PENINSULA GATEWAY
PERKINS & COMPANY PC
PETERSEN & EVANS ENTERPRISES
PETERSON PACIFIC CORP
PIERCE COUNTY BUSINESS EXAMINER
PLANNING INFORMATION CORPORATION
PLUM CREEK MANAGEMENT CO
PLUM CREEK TIMBER CO
PLUM CREEK TIMBER CO L P
POPE & TALBOT INC
POWELL GOSS & HERRMANN
PRAIRIE WOOD PRODUCTS
RD PRODUCTIONS
RF MATTEI & ASSOC INC
RW JACKS LOGGING & ROAD BLDG CO
R-Z PUBLISHING INC
RAFTEC
RAMSAY TREE FARMS
RAN-SAN ENTERPRISES
RANDOM LENGTHS
READING'S CREEK TREE FARM
RECON
REDWOOD SCIENCES LAB
REEVES KAHN & EDER
REINHART & ASSOC
RESERVATION RANCH
RESORT AT THE MOUNTAIN
RESOURCES NORTHWEST INC
RICE LOGGING CO
ROBERT E THOMAS ATTORNEY
RODENBOUGH LOGGING
ROGERS CONSTRUCTION INC
ROGUE RIVER N F
ROSE LOGGING
ROSEBURG FOREST PRODUCTS
ROSEBURG RESOURCES CO
ROSS-SIMMONS HARDWOOD LUMBER
ROUGH & READY LUMBER CO
SDS LUMBER CO
SEC INC
SO HEALER
SPO PARTNERS & CO
SALEM ELECTRIC COOP
SAPP BROTHERS LOGGING INC
SCHMIDBAUER LUMBER INC
SCIENTIFIC CERTIFICATION SYSTEMS
SCOTT LAND & TIMBER CO

SECOND GROWTH INC
SENECA SAWMILL CO
SHAPIRO & ASSOC INC
SHASTA LAND MANAGEMENT
SHILOH FOREST ENT INC
SHINDLER-MCNAIR GUIDE SERVICE
SHINGLETOWN LOGGING
SIEGMUND LOGGING CO INC
SIERRA PACIFIC INDUSTRIES
SILVA TREE MANAGEMENT
SILVER BUTTE TIMBER CO
SIMONARSON LAW FIRM
SIMPLEX MFG CO
SIMPSON TIMBER CO
SISKIYOU CO FARM BUREAU
SISKIYOU GENERAL HOSPITAL
SISKIYOU PROJECT
SIUSLAW TIMBER OPERATORS ASSN
SO ORE LOG SCALING/GRADING BUREAU
SOUTH COAST LUMBER CO
SPALDING & SON INC
SPRINGFIELD FOREST PRODUCTS
STARFIRE LUMBER CO
STATES INDUSTRIES INC
STEPHENS & ASSOCIATES
STIMSON LUMBER COMPANY
STOKES CONSTRUCTION CO INC
STONE FOREST INDUSTRIES
STU JONES LUMBER
SUN STUDS INC
SUNDANCE LUMBER CO INC
SUPERIOR LUMBER CO
SWANCO TIMBER INC
SWANSON BROS LUMBER CO
TW RESOURCES
TACOMA PUBLIC UTILITIES
TAYLOR LUMBER & TREATING INC
TETRA TECH INC
THE CADDIS FLY ANGLING SHOP
THE CAMPBELL GROUP
THE CONSULTANTS GROUP
THE DRAIN ENTERPRISE
THE ECONOMICS RESOURCE GROUP
THE HEARST CORP
THE NATURE CONSERVANCY
THE SEAMLESS WEB
THE UMBRELLA
THOMAS CREEK LUMBER & LOG CO
TILLER MARKET
TIMBER & WOOD PRODUCTS DIVISION
TIMBER DATA CO
TIMBER PRODUCTS CO
TIMBERCO INC
TIMELESS ENTERPRISES
TOTAL TREE LOGGING INC
TOWNE CENTER R E
TRANS COAST FINANCIAL INC
TRIANGLE VENEER INC
US BANCORP
UMPQUA WATERSHEDS
UNITED STAND
VAAGEN BROTHERS LUMBER INC
VANPORT MFG INC
VITTZ
WKO INC
WTD INDUSTRIES INC
WARDS HOME RANCH HEREFORDS
WEAVERVILLE REALTY INC
WESTERN AREA POWER ADMINISTRATION
WESTERN FOREST INDUSTRY ASSOC
WESTERN TIMBER SERVICES INC
WETSEL-OVIATT LUMBER CO
WEYERHAEUSER CO
WEYERHAEUSER CO LIBRARY
WEYERHAEUSER CORP HEADQUARTERS
WHEELABRATOR SHASTA ENERGY CO
WILDLANDS PROJECT
WILLAMETTE INDUSTRIES INC
WILLIAM C STILES & ASSOCIATES
WILLITS ENVIRONMENTAL CENTER
WILLOW LAKE RESORT
WINTHROP ASSOCIATES
WM BEATY & ASSOC INC
WOOD FIBER INDUSTRIES
WOOD FIBRE NORTHWEST
WOODCHIP INC
WOODS PRODUCTS INDUSTRIES
WOOLLEY ENTERPRISES INC
ZIP-O-LOG MILLS INC
ZUBER & SON LOGGING INCORPORATED

## INTEREST GROUPS

ALPINE LAKES PROTECTION SOCIETY
ALSEA VALLEY ALLIANCE
ALTA CALIFORNIA ALLIANCE
AMERICAN FOREST & PAPER ASSN
AMERICAN FORESTS
AMERICAN FORESTS PACIFIC OFFICE
AMERICAN MOTORCYCLIST ASSN
AMERICAN PLYWOOD ASSN
AMERICAN SOCIETY OF LANDSCAPE ARCHT
ANCIENT FOREST INTL
APPLEGATE ROUGHRIDERS M/C
ARIZONA TRAPPERS ASSOC
ASSN OF WESTERN PULP & PAPER WORKRS
ASSOC OF NW STEELHEADERS BEAV CHPTR
ASSOC OF NW STEELHEADERS HABITAT
ASSOCIATION OF O & C COUNTIES
ASSOCIATION OF OREGON ARCHEOLOGISTS
AUDUBON SOCIETY
AUDUBON SOCIETY OF CORVALLIS
AWPPW # 5
BANDON FISHERMENS ASSN
BIDWELL WILDLIFE REHABILITATION
BIG FOOT ALLIANCE
BLACK HILLS AUDUBON SOCIETY
BLUERIBBON COALITION
BROOKINGS-HARBOR LIONS CLUB
BROWNSVILLE PIONEER SADDLE CLUB
BUTTE COUNTY CITIZENS FOR FAIR GOVT
CALIFORNIA FOREST LANDOWNERS
CALIFORNIA ENDURO RIDERS ASSN
CALIFORNIA FORESTRY ASSN
CALIFORNIA IU RIVER SPORT FISHING
CALIFORNIA NEVADA SNOWMOBILE ASSN
CALIFORNIA SPORTSMENS TASK FORCE
CALIFORNIA WOMEN IN TIMBER
CARPENTERS UNIONS 1707 & 1036
CASCADE GEOGRAPHIC SOCIETY
CATTLEMEN & CATTLEWOMEN
CAVENHAM FOREST INDUSTRIES
CHRISTIAN CABLE MINISTRIES
CITIZEN ADVISORY COMMITTEE
CITIZENS INTERESTED IN BULL RUN
CITIZENS OF MCCULLY MTN
COAST RANGE ASSOCIATION
COLUMBIA RIVER GIRL SCOUT COUNCIL
COMMUNITIES FOR A GREAT OREGON
COMMUNITY RELATIONS ASSN
COMMUNITY TRAIL VOLUNTEERS
CONCERNED CITIZENS
CONCERNED FRIENDS OF THE WINEMA
CONSERVATION CHR NATIVE PLNT SOC OF
COOS BAY-NORTH BEND WATER BOARD
COOS FOREST PROTECTIVE ASSN
COW CREEK PAC
DEER CREEK VALLEY NATRL RES CONS
DEFENDERS OF WILDLIFE
DON'T WASTE ARIZONA INC
DOUGLAS TIMBER OPERATORS INC
EBASCO ENVIRONMENTAL
ECOLOGICAL SOCIETY OF AMERICA
EEL RUSSIAN RIVER COMMISSION
ENVIRONMENTAL ADVOCATES/CLIC
FEDERATION OF FLY FISHERMEN
FOREST CONSERVATION ASSN

FRIENDS OF TEHACHAPI
FRIENDS OF THE COQUILLE RIVER
FRIENDS OF THE GREENSPRINGS
FRIENDS OF THE METOLIUS
GOLDEN WEST WOMEN FLY FISHERS
GOVT CAMP REC ASSOC
GREATER ECOSYSTEM ALLIANCE
GUARDIANS OF LARCH MOUNTAIN
GUILCENE ANCIENT FOREST COALITION
HAYFORK COMMUNITY CHURCH
HONEY RUN COVERED BRIDGE ASSOC
HUMAINE SOCIETY OF THE U S
IMBA
IDAHOANS FOR FOOD & FIBER
ILLINOIS VALLEY FOREST WATCH
INTL LONGSHORE & WAREHOUSEMENS UN
INTL MARINE MAMMAL ASSOC
IZAAK WALTON LEAGUE OF AMERICA INC
KALIMOPSIS AUDUBON
KELLER ENVIRONMENTAL ASSOC
KETTLE RANGE CONSERVATION GROUP
KING COUNTY DEMOCRATS
KIWANIS CLUB OF COQUILLE
KLAMATH BASIN $H_2O$ RESOURCES COMM
KLAMATH BASIN WATERFOWL ASSN
KLAMATH BASIN WOMEN FOR AG
KLAMATH FOREST ALLIANCE
LABORERS LOCAL 791
LAKEVIEW MULTIPLE USE ADVISORY CNCL
LANE COUNTY AUDUBON SOCIETY
LEAGUE OF WOMEN VOTERS
LEAGUE OF WOMEN VOTERS LANE CO
LEAGUE OF WOMEN VOTERS OF UMPQUA
LEAGUE OF WOMEN VOTERS/CURRY CNTY
LEOPOLD CLUB
LINCOLN CO MYCOLOGICAL SOCIETY
LOCAL RESIDENTS FOR OLD GROWTH
LOS ANGELES EARTH FIRST
LPIW 2835
LPIW LOCAL 2784
LUMBER & SAWMILL WORKERS #2633
MATTOLE RESTORATION COUNCIL
MCKENZIE FLYFISHERS
MCKENZIE GUARDIANS
MINERALS EXPLORATION COALITION
MOLALLA SADDLE CLUB OET
MOTORCYCLE RIDERS ASSN
MOUSE MT FOREST COUNCIL
MTN ANTHROPOLOGICAL RESEARCH
MULTIPLE USE COALITION FOR TRAILS
NAPA-SOLANO AUDUBON SOCIETY
NATIONAL ASSN OF CONSERVATION DIST
NATIONAL ASSN OF HOUSE BUILDERS
NATIONAL AUDUBON SOCIETY
NATIONAL WILDLIFE FEDERATION
NATIVE PLANT SOCIETY
NATIVE PLANT SOCIETY OF OREGON
NATIVE YEW CONSERVATION COUNCIL
NATURE OF OR INFORMATION CENTER
NEW AGE MISSION INC
NOR CAL ENVIRONMENTAL COALITION
NORTH BEND GARDEN CLUB
NORTH CASCADES CONSERV COUNCIL
N CENTRAL WASH AUDUBON SOCIETY
NORTH COAST ATV CLUB
NORTH COAST ENVIRONMENTAL CENTER
NW FORESTRY ASSN
NW MINING ASSOC
NW REGIONAL DIR SIERRA CLUB
NW TIMBERWORKERS RES COUNCIL
NW POWER PLANNING COUNCIL
NW REFORESTATION CONTRACTORS ASSN
NRDC
OFIC
OLYMPIC LABOR COUNCIL
OLYMPIC PARK ASSOCIATES
OR EQUESTRIAN TRAILS
OR FOREST PRODUCTS TRANSPORT
OR GUIDES & PACKERS
OR HUNTERS ASSN/EMERALD VLLY CH
OR HUNTERS ASSOC
OR LANDS COALITION
OR NATURAL DESERT ASSN
OR SHORES CONSERVATION COALITIN
OR SMALL WOODLANDS ASSN
OR SOCIETY AMERICAN FORESTERS
OR SOUTH COAST FISHERMEN INC
OR STATE GRANGE
OR UNITED SPORTING DOGS
OR WATERFOWL & WETLANDS ASSOC
OR WOMEN IN TIMBER
OREGONIANS FOR FOOD & SHELTER
ORGANIZATION OF WALTON LANDOWNERS
PACIFIC NORTHWEST WATERWAYS ASSN
PACIFIC RIVERS COUNCIL
PEOPLE FOR ANIMAL RIGHTS
PILCHUCK AUDUBON SOCIETY
PINE CREEK MTN ESTATES
POLAR BEAR SNO-MOBILE CLUB
PORTLAND AUDUBON SOCIETY
PUBLIC FORESTRY FOUNDATION
PUBLIC LANDS FOUNDATION
RED MOUNTAIN ASSN
REDWOOD GUN CLUB
REDWOOD REGION AUDUBON SOCIETY
RESOURCES FOR THE FUTURE
ROCKYDALE NEIGHBORHOOD ASSN
ROGUE GROUP SIERRA CLUB
ROGUE RIVER GUIDES ASSN
SACRAMENTO AUDUBON SOCIETY
SACRAMENTO RIVER PRESERVATION TRUST
SACRED EARTH COALITION
SANTIAM WILDERNESS COMMITTEE
SAVE AMERICAS FORESTS
SAVE OUR KLAMATH RIVER
SAVE OUR SAWMILLS
SAVE THE KLAMATH RIVER
SENIOR NATIVE OREGONIANS
SHASTA CO ASSN OF REC LAND USERS
SHASTA GEM & MINERAL SOCIETY
SHASTA LAND MANAGEMENT
SHASTA MINERS & PROSPECTERS
SHORELINE EDUCATION FOR AWARENESS
SIERRA CASCADE LOGGING CONF
SIERRA CLUB
SIERRA CLUB FOREST COMMITTEE
SIERRA CLUB LEGAL DEFENSE FUND
SIERRA CLUB NO CA/NV/HI FIELD OFC
SIERRA CLUB OREGON CHAPTER
SIERRA CLUB ROGUE GROUP
SIERRA CLUB SAN FRANCISCO BAY CHPTR
SIERRA CLUB-CASCADE CHAPTER
SIERRA CLUB-REDWOOD CHAPTER
SIERRA CLUB-YAHI GROUP
SIERRA PACIFIC INDUSTRIES
SISKIYOU AUDUBON SOCIETY
SISKIYOU COUNTY CATTLEMENS ASSN
SISKIYOU COUNTY HISTORICAL SOCIETY
SISKIYOU TRAIL RIDERS & M R A
SIUSLAW TIMBER OPERATORS ASSN
SOCIETY OF AMERICAN FORESTERS
SODA MOUNTAIN WILDERNESS COUNCIL
SOUTHERN OREGON ALLIANCE FLR RES
SOUTHERN OREGON TIMBER INDUST ASSN
SOUTHERN WILLAMETTE EARTH FIRST
SPORT FISHING INSTITUTE
SPORTSMENS COUNCIL OF NO CALIFORNIA
STEAMBOATERS
SWEET HOME ROCK CLUB
TEAM
TREES
TALENT WATERSHED INTERCOMM GROUP
TEN-MILE CREEK ASSN
THE CAMPBELL GROUP INC
THE HUMANE SOCIETY OF THE U S
THE MCCONNELL FOUNDATION

THE MOUNTAINEERS
THE NATURE CONSERVANCY
THE RESEARCH GROUP
THE WILDERNESS SOCIETY
THE WILDLIFE SOCIETY
THE WILLIAMSON RIVER CLUB
TIMBER COUNTIES SCHOOL COALITION
TIMBER IMPACT RESOURCE OFFICE
TOM LONG WATERSHED ASSN
TRIANGLE GRANGE # 533
TRINITY COUNTY MINERS ALLIANCE
TROUT UNLIMITED
TULELAKE GROWERS ASSOCIATION
TWIN ROCKS INHOLDERS ASSOC
UMPQUA VALLEY AUDUBON
UMQUA CORRIDOR ASSOC
UNITED PAPERWORKERS
UNLIMITED PHEASANTS
VALLEYVILLE HANG GLIDING ASSN
WWPA
WA CONTRACT LOGGERS ASSN
WA LANDS COALITION
WA NATIVE PLANT SOCIETY
WA STATE LABOR COUNCIL
WA STATE TRAPPERS ASSN
WCIW LOCAL 2805
WESTERN FOREST INDUSTRIES ASSN
WESTERN MINING COUNCIL INC
WESTERN NETWORK
WESTERN WILDLIFE
WHEELABRATOR SHASTA ENERGY
WILDERNESS SOCIETY
WILLAMETTE INDUSTRIES
WILLAMETTE TIMBERMEN ASSN INC
WILLIAMS WATERSHED PROTECTION ASSOC
WOMEN & MOTHERS OF THE EARTH
WOODWORKERS 3-38
XERCES SOCIETY
YAMHILL VALLEY PEACEMAKERS
YELLOW RIBBON COALITION
YOLO ENVIRONMENTAL RESOURCE CTR
YOSEMITE AREA AUDUBON

## AMERICAN INDIAN TRIBES AND NATIONS

CALIFORNIA INDIAN LEGAL SERVICES
CONF TRIBES OF GRAND RONDE
CONFEDERATED MODOC & PAIUTE TRIBES
CONFEDERATED TRIBES OF COOS ET AL
CONFEDERATED TRIBES/SILETZ INDIANS
HOOPA TRIBAL FORESTRY
KARUK TRIBE OF CALIFORNIA
KLAMATH RIVER INDIAN
NOR-EL-MUK WINTU INDIAN TRIBE
NW INDIAN FISHERIES COMMISSION
PORT GAMBLE S'KLALLAM TRIBE
PUYALLUP TRIBAL TFW PROGRAM
QUARTZ VALLEY INDIAN RESERVATION
QUILEUTE TRIBAL COUNCIL
QUINAULT INDIAN NATION
SAUK SUIATTLE INDIAN TRIBE
TULALIP TRIBES - FISHERIES DEPT

## LIBRARIES, SCHOOLS, AND UNIVERSITIES

AIHS
ALBANY PUBLIC LIBRARY
ARIZONA STATE UNIVERSITY
BANDON PUBLIC LIBRARY
BELLEVUE COMMUNITY COLLEGE LIBRARY
BROWNSVILLE COMMUNITY LIBRARY
CA ACADEMY OF SCIENCES
CA STATE UNIVERSITY
CHICO STATE UNIVERSITY
CLACKAMAS CO LIBRARY REF DEPT
CLEMSON UNIVERSITY
COFFENBERRY JR HIGH SCHOOL
COLORADO STATE UNIVERSITY
COOS BAY PUBLIC LIBRARY
CORNELL UNIVERSITY
DEEP SPRINGS COLLEGE
DENVER BOTANIC GARDENS
DEPT OF FOREST RES U OF MN
DOCUMENTS DEPT RM 104A
DYNAMIC LIBRARY
E C O FORESTRY INSTITUTE
FLORA M LAIRD MEMORIAL LIBRARY
GRAYS HARBOR COLLEGE
HUMBOLDT STATE UNIVERSITY
ILLINOIS STATE UNIVERSITY
ILLINOIS VALLEY BRANCH LIBRARY
INDIAN INSTITUTE OF MANAGEMENT
INSTITUTE FOR ENVIRONMENTAL STUDIES
JONES & STOKES ASSOC-LIBRARY
JOSEPHINE COUNTY LIBRARY
KANSAS STATE UNIVERSITY
KITSAP REGIONAL LIBRARY
KLAMATH UNION HIGH SCHOOL
LAKESIDE PUBLIC LIBRARY
LANE COMMUNITY COLLEGE LIBRARY
LANE EDUCATION SERVICE DIST
LIBRARY OF CONGRESS
LOS ANGELES MISSION COLLEGE
LOUISIANA STATE UNIVERSITY
MICHIGAN TECHNOLOGICAL UNIVERSITY
MT HOOD COMMUNITY COLLEGE
NEVADA STATE LIBRARY & ARCHIVES
NORTH BEND PUBLIC LIBRARY
NORTH CAROLINA STATE UNIVERSITY
NORTH CASCADES INSTITUTE
NORTHERN ILLINOIS UNIVERSITY
NORTHWESTERN SCHOOL OF LAW
OSU EXTENSION SERVICE
OSU/FOREST RESOURCES DEPT
OKLAHOMA DEPT OF LIBRARIES
OREGON STATE LIBRARY
OREGON STATE UNIVERSITY
OREGON STATE UNIVERSITY/EPA
PHPPO
PORT ORFORD LIBRARY
RAMAPO COLLEGE OF NJ/ADJUNCT FACLTY
RICHLAND PUBLIC LIBRARY
RUCH BRANCH LIBRARY
SALEM PUBLIC LIBRARY
SCHOOL OF FOREST RESOURCES - UAM
SEATTLE CENTRAL COMMUNITY COLL LBRY
SHASTA COUNTY LIBRARY
SHERIDAN PUBLIC LIBRARY
SIMPSON COLLEGE
SISKIYOU CO LIBRARY
SISKIYOU REGIONAL EDUCATION PROJECT
SMITHSONIAN INSTITUTION
SOUTH ILLINOIS UNIV AT CARBONDALE
SOUTHERN OREGON STATE COLLEGE
SOUTHWESTERN ORE COMM COLLEGE
STANFORD UNIVERSITY
SUMMIT KLIZ SCHOOL
TRIANGLE LAKE HIGH SCHOOL
UC COOPERATIVE EXTENSION
U OF ALBERTA
U OF ARIZONA
U OF ARKANSAS
U OF CALIFORNIA
U OF DAYTON
U OF GEORGIA
U OF ILLINOIS
U OF MARYLAND
U OF MINNESOTA
U OF NORTH CAROLINA
U OF OREGON
U OF OREGON LAW SCHOOL
U OF ORE WESTERN NAT RES LAW CLINIC
U OF PENNSYLVANIA
U OF VERMONT
U OF WASHINGTON
U OF WASHINGTON LIBRARY

U OF WASH/NW POLICY CENTER
U OF WISCONSIN-MADISON
UMPQUA COMMUNITY COLLEGE
UNIVERSITY PLACE
UPIV
VALLEY LIBRARY
WA STATE UNIV AT VANCOUVER
WASHINGTON INSTITUTE
WASHINGTON STATE UNIVERSITY
WHISKEY TOWN ENVIRONMENTAL SCHOOL
WILDLIFE MANAGEMENT INSTITUTE
WILLAMETTE UNIVERSITY
WILLAMINA PUBLIC LIBRARY
WILSON LIBRARY
YAKIMA VALLEY REGIONAL LIBRARY

## MEDIA

ALBANY DEMOCRAT HERALD
ASSOCIATED PRESS
CAPITAL PRESS
CENTRAL OREGONIAN
CENTRAL VALLEY TIMES
CHICO NEWS & REVIEW
COLLEGE OF THE REDWOODS LIBRARY
COTTAGE GROVE SENTINEL
CURRY COUNTY REPORTER
DAILY ENVIORNMENT
DAYTON CHRONICLE
FEATHER RIVER BULLETIN
FOREST ENGINEERS INCORPORATED
GAZETTE-TIMES
GRANTS PASS DAILY COURIER
HEADLIGHT-HERALD
HERALD & NEWS
ILLINOIS VALLEY NEWS
KINS
KQMS/KSHA RADIO
KRCR-TV
KSHR
KSYC-KYRE
KWSD/KEDY
KBRC RADIO
KERR LIBRARY
KHSL TV
KKFX RADIO
KLOG RADIO
KMAS RADIO
KOOS/KHSN
KOZI RADIO
KPBX RADIO
KQBE RADIO
KVOS-TV NEWS
KWHO RADIO
KWNC RADIO
KXL
LAKE STEVENS JOURNAL
LOGGERS WORLD PUBLICATIONS
MARPLES BUSINESS NEWSLETTER
METHOW VALLEY NEWS
NATURE CONSERVANCY NEWSLETTER
NEWPORT NEWS-TIMES
NEWS-TIMES
OKANOGAN VALLEY GAZETTE-TRIBUNE
OMAK CHRONICLE
OREGON PUBLIC BROADCASTING
REATERS
RECORD SEARCHLIGHT
SEATTLE POST-INTELLIGENCER
SEATTLE TIMES
SISKIYOU DAILY NEWS
SKAGIT VALLEY HERALD
SPOKESMAN REVIEW
STATESMAN JOURNAL
THE ASSOCIATED PRESS
THE BULLETIN
THE COLUMBIAN
THE COURIER-HERALD
THE DAILY ASTORIAN
THE DAILY NEWS
THE INDEPENDENT
THE MORNING NEWS TRIBUNE
THE NEWS-REVIEW
THE REGISTER-GUARD
THE SPOKESMAN-REVIEW
THE SUN
THE TIMES-STANDARD
THE WORLD NEWSPAPER
TRINITY JOURNAL
WCFAC
WAHKIAKUM COUNTY EAGLE
WEEKLY NEWSPAPER
WENATCHEE WORLD

# INDIVIDUALS

A J BECK
A GIUSTINA
ABIGAIL KLIPS
ACHIM BASSLER
ADRIAN JUNCOSA
AILEEN KAYE
AL NASBY
AL CHASE
ALAN L TRASK SR
ALAN PAROLINI
ALAN WICKSTROM
ALAN MATSUNO
ALBERT BRIDGES
ALBERT ARNST
ALEX PERU
ALICE M DENHAM
ALLAN H VOGEL
ALLAN ADAMS
ALLEN STECK
ALLEN W REITAN
ALLEN COOPERRIDER
ALLEN W NEFF
ALMA ANDERSON
ALVIN W URQUHART
ALVIN THOMPSON
ANDREA J SOLOMON
ANDREW K HARTZELL
ANDREW GUZIE
ANN EISSINGER
ANN W CAVANAGH
ANNE KINNAMAN
ANTHONY D WARREN
ART ZIMMER
ARTHUR M STOVER
ARTHUR W BRENNAN
ARTHUR SMYTH
ARTHUR BOESCHEN
ARTHUR STEVENS
AUDREW E CARLSON
AUDREY KNOTT
AVANN WEBER
AVIS RANA
B D BURGE
B E HALL
BARBARA ASHINHURST
BARBARA BLACKMORE
BARBARA ROSENKOTTER
BARRY BOULTON
BARRY SNITKIN
BENJAMIN B STOUT
BERNIE AGRONS
BETHEL & ALBERT HARRIS
BEVERLY FORKNER
BEVERLY PROSSER
BHAGWATI PODDAR
BILL BAKKE
BILL GRIESAR
BILL GRAY
BILL LEMONS
BILL & JANE STONE
BILL P MICSAN
BILLIE D NICPON
BILLY J KINZER
BIRAN EVANS
BLANCHE BLANKENSHIP
BOB & SHARON SUTTON
BOB WINNIFORD
BOB TAYLOR
BOB CRAIN
BOB HOSTETTER
BOB MASON
BOB GUNTHER
BOB GERL
BOB STRAUB
BOB RIGGLMAN
BOB COTTER
BOB SCHRAMEK
BOB SCHWARZ
BOBBIE HARMS
BONNIE CLOYD
BOYCE M BAKER
BRAD JARVIS
BRAD & SYLVIA LEWIS
BRAD YAZZOLINO
BRADFORD T STEVENS
BRIAN PILCHER
BRIAN J FEDERICI
BRIAN SINDT
BRUCE BARKER
BRUCE W WHITE
BRUCE HEFFINGTON
BRUCE CAMPBELL
BRUNO C MEYER
BRYAN K HILL
BUD HOEKSTRA
BUD NADEAU
BYRD A LOCHTIE
BYRNE C MANSON
BYRON J WOOD
BYRON G WONG
BYRON RENDAR
C E HUBBARD
C L STAHL
C S LAMOTTE
C W BECRAFT
CALVIN C KUSCHEL
CANDIS L CONDO
CARL H SCHWARZENBERG
CARL M OWEN
CARL WEIDERT
CARLOS R GARCIA
CAROL MCWILLIAMS
CAROL EILEEN MONE PAGE
CAROL B ELTON
CARRIE NEVIN
CATHIE OLCOTT
CELESTE WHEELER
CHAE KWAK
CHARLENE BROWN
CHARLENE EMS
CHARLES C RAINES
CHARLES F WEST
CHARLES MCGILLUREY
CHARLES MAGEE JR
CHARLES LIVINGSTON
CHARLES J RITZMAN
CHARLES L BARACCO
CHARLES R WHITE
CHARLES W BOOHER
CHARLES P VAN EPPS
CHARLOTTE TOUHEY
CHAUNCEY C HUGHES
CHERI BROOKS
CHERIE S LECLAIR
CHESTER MCCONNEL
CHITRA TURNER
CHRIS MATERA
CHRIS MEURER
CHRIS FULTON
CHRIS PALMQUEST
CHRIS COX
CHRIS ANDERSON
CHRIS TAPP
CHRIS ENRIGHT
CHRIS TOPIK
CHRISTOPHER ORSINGER
CHRISTY BRITT
CHUCK WOOSLEY
CINDY E SOUDERS
CLAIRE PAYNE
CLAMORE P NEEDHAM
CLARENCE A WILLIAMS
CLARENCE F KRAUSE JR
CLARENCE H JACOBSON
CLARENCE L BARGER
CLARK L MILLER
CLIFF MANN
CLIFF NYMAN
CLOVER M FALVEY
CLYDE L GROSHONG
COLE H GARDINER
COLIN LYNCH
CONNIE GEORGIOU
CONNIE JACQUES
CONSTANTINA ECONOMOU
COREY BIDWELL
CRAIG SHELBY
CRAIG HANNEMAN
CRAIG B SNIDER
CRAIG EMMETT
CURT CONOVER
CURT SCHNEIDER
CURTIS MITCHELL
CYNTHIA BLACK
CYNTHIA DIAMA
D G SMITH
D F FLORA
D JACK DARLEY
D CORDUIRO

D BUSHNELL
DALE LUHMAN
DALE NESBITT
DALE DOTSON
DALE SPIER
DALE D LYSNE
DALE A STIRLING
DAN MUMMEY
DAN NEWTON
DAN SILVER
DAN MORRISON
DAN PIETILA
DAN EKBLAW
DAN BERMAN
DAN COLL
DAN STROH
DAN KIRKPATRICK
DANIEL GOLTZ
DANIEL J BUCKLEY III
DANIEL G COHOON
DANIEL ROBERTSON
DARREL GUTZLER
DARYL G HAUSER
DAVE SAWYER
DAVE WILLIS
DAVE RUSSEL
DAVE & DONNA ROCHA
DAVE & CATHY HOCKER
DAVE RENWALD
DAVE ANDERSON
DAVE MAGIN
DAVID S MICKELSON
DAVID V WEISSBECK
DAVID L MICKELSON
DAVID R VAN ARSDALL
DAVID EDELSON
DAVID L GREEN
DAVID KEYT
DAVID W MITCHELL
DAVID AKINS
DAVID KRUEGER
DAVID JENSEN
DAVID LUEDERS
DAVID PROW
DAVID SWEETMAN
DAVID RUBIN
DAVID IMPER
DAVID GREENWALD
DAVID BARRINGER
DAVID K CARTER
DAVID BAUMAN
DAVID FULLER
DAVID GLEN
DAVID GIBSON
DAVID WELT
DAVID ALTMANN
DAVID E HALE
DAVID J ANDERSON
DAVID J MESSERLE
DAVID WERNTZ
DAVIS WRIGHT
DEAN EDWARDS
DEANNA MUELLER-CRISPIN
DEANNA BARBARIA
DEBBIE LUKAS
DEBBY SWEETEN
DEBORAH MURPHY
DEBORAH DRAEGER
DELBERT ASH
DELMAR JANSON
DELORES PORCH
DENISE KALAKAY
DENISE R CANALS
DENNIS SHERWOOD
DENNIS SMITH
DENNIS REID
DENNIS POPE
DENNIS PHELPS
DENNIS M CULP
DEXTER GIBSON
DEZH PAGEN
DIANN MACRAE
DICK POSEKANY
DICK PELLISSIER
DICK TURNER
DICK NIKOLAI
DON KIMBALL
DON HAMBLIN
DON MENCH
DON CARLTON
DON PALKO
DON & PEG TOWNSEND
DON R FECHTNER
DON & JAN KNAUER
DON YON
DON/LINDA/SETH PARKS
DON STRASSER
DONALD L OWEN
DONALD M DARLING
DONALD L HUMMEL
DONALD K RICE
DONALD P RAAB
DONALD M SUTHERLAND
DONALD HILL
DONALD E HOPKINS
DONALD P WHITE
DONALD WINN
DONALD E LONG
DONALD E WALKER SR
DONNA AMOS
DONNA WALKER
DONNA STRICKLIN
DONNA MURRAY
DONNA M ALBER
DOTTIE SMITH
DOUG LEISZ
DOUG HEIKEN
DOUG MARKER
DOUG DOUGHERTY
DOUGLAS SWCD
DOUGLAS A MACINNIS
DOUGLAS POLLOCK
DOUGLASS PERSKE
DOVA M MAINE
DUANE SMITH
DWIGHT WILLARD
E DALE
E ZAHN
E H KOBERNIK
E L WHITE
E L BICKEL
EARL W MORRIS
EARL W SMILEY
EARL A MILLER
EBERHARD BRUNNER
ED HOOVER
ED MALONEY
ED GILMAN
EDMUND R WALKER JR
EDWARD C WOLF
EDWARD D KING
EDWARD C HARRIS
EDWARD G LIVINGSTON
EDWARD M SMITH
EDWARD ALDRICH
EDWARD DANEHY
EDWARD HALL
EDWARD S SHERMAN
EDWARD W INMAN
EDWARD T MONKS
EDWIN G KATLAS
EDWIN H CAMPBELL
EDWIN B ABBOTT
ELAINE PLAISANCE
ELAINE ROBIN
ELAINE MCANDREWS
ELDON H KENT
ELEANOR DYKE
ELINOR SCHWARTZ
ELINOR A LEVIN
ELIOT H JENKINS
ELIZABETH HAMILTON
ELIZABETH DUNN
ELIZABETH HOLLIDAY
ELIZABETH BLOEMER
ELIZABETH BOOTH
ELLICE BOSWORTH
ELMER R SIMMONS SR
EMERY E JETT
ERIC L STONE
ERIC A BOHM
ERIC COX
ERIC WHITE
ERIC PIERCE
ERIK BERGLUND
ERNEST E SMITH
ERNEST CARLSON
ERNEST O'BYRNE
ERNESTINE SMITH
ERNIE BRITO
EUGENE I MAJEROWICZ
EUGENE GJERTSEN
EUGENE LAIHO
EVELYN THOMPSON
EVELYN R OUSTERHOUT

EVELYN STRAUSS
EVERETT PETERSON
EVERETT WINTER
F D LOSPALLUTO
F M BUSBY
FELICIA ROUNDS BEARDSLEY
FERN & JOHN HANE
FLORENCE MURPHY
FLOYD GIESE
FRAN RECHT
FRANCES L BENNETT
FRANCIS KUHLE
FRANCIS S LANDRUM
FRANK ZILLA
FRANK MILEHAM
FRANK L ROUSH
FRANK R CETERA
FRANK BELLINGHAUSEN
FRANK COLVER
FRANK ERRIDGE
FRED RICKERT
FRED SAWYER
FRED L RINNE
FRED A HENDRIX
G H SHARRER
G L MASTERS
G COLEMAN
GAIRY NEYNOLDS
GALE MILLER
GALE STALEY
GARNER L POOL
GARTH SANDERS
GARY KISH
GARY LISMAN
GARY HAMLET
GARY A CAVE
GARY MEYER
GARY E SCHERER
GARY BETTS
GARY ELDER
GARY FOGLIO
GARY GUNDLACH
GARY L MCDONALD
GAY L WEAVER
GAYLE ENGLE
GAYLORD GRAMS
GENE SERR
GENE MASH
GENE THOMPSON
GENE LANDOLT
GEORGE E WALKER
GEORGE M CHASE
GEORGE E LANEY
GEORGE T FLANAGAN
GEORGE T BOEHNKE
GEORGE BRIDGES
GEORGE DRAFFAN
GEORGE MYDEGGER
GEORGE B HUTCHINSON
GERALD HARAM
GERALD L BAKER
GERALD CARR
GERRY SHAPIRO
GILBERT A BROWN
GISELA KINNEY
GLADYS ROBINSON
GLEN E CARNES
GLENN EADES
GLORY M HURST
GORDON JOHNSON
GORDON MILLN RIGGS
GRAHAM J WRIGHT
GRANT VAN PELT
GRANT D WERSCHKULL
GRANT KISTLER
GREG REDDELL
GREG NORTON
GREG ROSE
GREG WELLISH
GREG FOSTER
GREG ADAMS
GUY ORCUTT
GUY PASTEUR
GWEN THOELE
H J WHITAKER
H R JOSEPHSON
H JANE HERBST
HAL BARTON
HAL MACY
HARLAN & T M ROFF
HARLAND JOHNSON
HAROLD SAUNDERS
HAROLD E WALD
HARRY E WILSON
HARRY M DEMARAY
HARRY A TAYLOR
HARRY W MCWHORTER
HARRY/MARYJANE BURGER
HARRY KELLEY
HARRY METZGER
HARRY PIERSON JR
HARVEY F REYNOLDS
HARVEY W HOUSTON
HAZEL F WEAVER
HAZEL-LOUISE ROGERS
HELEN FARRENKOPF
HENRY J CALDWELL JR
HENRY D MABIE
HENRY & DONNA MICHELBRINK
HENRY VINTON
HERBERT KOHL
HERBERT L HAGLUND
HOMER MILLARD
HOMER L YATES
HOWARD E SMITH
HOWARD F BRUCE
HUGH DRAGICH
HUGH PAZ
IALO D STEPHENS
IDA SPAULDING
IMOGENE SCOTT
IRA J CHASE
IRENE L BATEY
IRENE M SEAVEY
IRVIN H WALSH
IVAN HOYER
J DANIEL KINNEY
J G DAUENHAUER
J W COSKEY
J CRAIG CARTER
JACK WEBER
JACK & DONNA BOHANNON
JACK D COLLINS
JACK L EGBERT
JACK VANSYOC
JACK FRIBERG
JACK T KRULL
JACK W LEWIS
JACK DOWNS
JACKIE SANDERS
JACOB L REED
JACQUELINE L MOFFATT
JAMES OVERSTREET
JAMES WALTHERS
JAMES SHEPHERD
JAMES POWERS
JAMES & DEBRA BERRY
JAMES A MCCALL
JAMES B EBLIN
JAMES B WEBSTER
JAMES MORGAN
JAMES E CRESWELL
JAMES M LEE
JAMES R HOUSTON
JAMES W HANSEN
JAMES G MILLER
JAMES F MOORE JR
JAMES E MCNEIL
JAMES E RIBACK
JAMES W NIELSEN
JAMES E DALZIEL
JAN WRONCY
JAN REAL
JAN CONITZ
JANA SOKALE
JANE ERICKSON
JANE E HAMEL
JANET DUNLAP
JANET M SAILER
JAY FARR
JEAN PLAISANCE
JEAN SWEET
JEAN C PRENDERGAST
JEAN-GUY MARTIN
JEAN C ROBERTS
JEANETTE PHELAN
JEFF WARREN
JEFF C AFFELD
JEFF MULLINS
JEFF LEE
JEFF ARD
JEFFERY L KELLER
JEFFREY SZMANIA
JEFFREY HARDING
JEFFREY S PRIME

JEFFREY JON BODE
JENNIE & BRYAN CORNELL
JENNIFER RIVAIS
JENNY ISHIDA
JERALD N HUTCHINS
JERRY SEDLAK
JERRY WINTERBOTHAM
JERRY MODUGNO
JERRY F BASSETT
JERRY CONE
JERRY GONZALES
JERRY DIERKEN
JESS EDWARD GARRISON
JESSIE WHEELER
JILL DONDERO
JIM WILLIAMS
JIM SHAFFER
JIM & CATHY KROIS
JIM OVERTON
JIM TODD
JIM HOPPER
JIM CLARKE
JIM COATES
JIM DOCHERTY
JIM FETY
JOAN C WRIGHT
JOAN CORBETT DINE
JOANNE BIGMAN
JODI L BUSH
JOE MAZZINI
JOE GRIGGS
JOE PATTON
JOE RICHTER
JOE AMICARELLA
JOE SHEIRBON
JOHANNA STEPHEN
JOHN GAFFIN
JOHN CAMPBELL
JOHN WILSON
JOHN SCHINNERER
JOHN SAVARESE
JOHN LONG
JOHN MANCINELLI
JOHN LARZABAL
JOHN LAFRENTZ
JOHN HOLZBERGER
JOHN PARKS
JOHN PRIOR
JOHN SAVARELE
JOHN SAEMANN
JOHN RAPF
JOHN NEMECEK
JOHN GEDDIE
JOHN WOODWARD
JOHN J PATRICK
JOHN J HORTSCH
JOHN H THOMAS
JOHN H PENAS
JOHN JAY ULLOTH
JOHN M BAUER
JOHN R SWANSON
JOHN R GARDNER
JOHN M SULLY
JOHN M SHERMAN
JOHN G WARD
JOHN F BREEDEN
JOHN A HAILEY
JOHN A DAVENPORT
JOHN & RENEE TOWNSLEY
JOHN & JULIA CARLSON
JOHN A PIKE
JOHN A SCHNITTKER
JOHN E VAN GORKOM
JOHN E BERKLUND
JOHN B COPELAND
JOHN V DAVIS
JOHN WYDICK
JOHNNY C FANCHER
JON CHRISTENSON
JON SHELDAHL
JONATHAN C SPERO
JOSEPH HINTON
JOSEPH MUNIZ
JOSEPH EBERSOLE
JOSEPH DANKO
JOSEPH BIELAVICZ
JOSEPH BOWER
JOSEPH R SINAI
JOYA FELTZIN
JUAN YRAGUEN
JUAN S ARCHULETA
JUANITA L PICKETT
JULIE NORMAN
KAREN WARTBURG
KAREN L CABRON
KAREN EASTLICK
KATHERINE JOHNSON
KATHLEEN DEVITA
KATHLEEN DODGE
KATHLEEN CASEY
KATHY CUNNINGHAM
KATHY & JIM BRASHERS
KEITH KALE
KEITH S BEDARD
KELLY J ROGERS
KEN MACKENZIE
KEN HAGEN
KENNETH COX
KENNETH TERPENING
KENNETH R LONG
KENNETH E KENNEDY
KENNETH E ELY
KENNETH BALES
KEVIN ROSE
KEVIN KREFFT
KEVIN SLACK
KEVIN MCBIRNEY
KIM R STOWE
KIM GURLEY
KIMBALL S ERDMAN
KIT MARX
KITT MURRISON
KLAAS VAN DE POL
KRIS WOBBE
L POWER
L L FESTUS HAWORTH
LACRETIA C SCHACHT
LAMAR NEWKIRK
LANA THURSTON
LARRY G PIERCE
LARRY HOAGLAND
LARRY ERICKSON
LARRY J BLAKE
LARRY MILLER
LARRY STOUTENBURGH
LARRY TURNER
LARRY WEHMEYER
LARRY C MAECHLER
LARRY MASON
LAURA GATES
LAUREN M TAYLOR
LAURIE WOODARD
LAURIE SCHIMMOELLER
LAVELLE POLK
LEE C OSBORNE
LEE C WEICHSELBAUM
LEE ZEIGLER
LEE BUNNELL
LEE WOODY
LELAND G ALBEE
LELAND COTTER
LEN & GRACE HENDERSON
LEO B MORSTAD
LEO L NAAPI
LEO P GIBSON
LEON D FOWLER
LEONA KUSLER
LEONARD A SOUTH
LEROY L BURNS
LEROY VOLZ
LES HELGESON
LESTER HINTON
LESTER PHELPS
LESTER FOX
LEWIS HANSEN
LINDA WILKINSON
LINDA YATES
LINDY WOLF
LISA BROWN
LLOYD M WEAST
LLOYD F HAMBY
LLOYD H KRAUSE
LODIE FULLER
LOIS CHERRY SHAW
LOIS DROBISH
LOLA LANDIS
LOLA MOULTON
LOREN G BLACKMER
LOREN J HINER
LORETTA STRINGFELLOW
LORI HENDRICKS
LORNIE WHITE
LOUIS MESSMER

LOUIS PIHA
LOUIS A LEPRY JR
LOUIS R RUDOLPH
LOUISE NICHOLSON
LOYD H LARREW
LUCILLE VINYARD
LYNDA K STEINEIR
M A CELAYETA
M J FITZGERALD
M J MITCHELL
M GRAYBILL
MALCOLM LIONEL
MALCOLM R FORD
MARC LIVERMAN
MARCIA A GAISER
MARCY SCHWARTZ
MARGARET KEISER
MARGARET FELDMAN
MARI N JENSEN
MARIA PARSON
MARIAN CHRISTIE
MARIAN B ORVIS
MARIANA D BORNHOLDT
MARIO S MAMONE
MARISE GWIN
MARK WEINHOLD
MARK SWING
MARK ZOUZAS
MARK ENDRIZZI
MARK SOMMER
MARK MILLER
MARLENE MASON
MARLIN F ZOLLMAN
MARTHA PAUL
MARTHA RICKER
MARTIN VAUGHN
MARTIN C PLYLER
MARTIN STEVENS
MARVIN GRUNBERG
MARVIN W MIZELL
MARY ELLEN NOYES
MARY G BAUR
MARY D JONES
MARY L BOICE
MARY JO WEBER
MARY L STEFFENSEN
MARY GRIFFIN
MARY HARMENING
MARY WIRTH
MARY MARKUS
MARY L BYFORD
MARYLOU/ROGER SCHNOES
MARYLYN MAYHEW
MATTHEW ROBINSON
MAURICE H OLSON
MAVIS MCCORMIC
MAX & NORMA BARZEC
MAXINE J DAVIES
MAYNARD ELLIS
MAYO TORGERSON
MEL JACKSON
MELVIN MCLEOD
MELVIN VAN DOMELEN
MERLE P HARGIS
MERRY GRISAK
MICAH BARBASH
MICHAEL E KOPLEIN
MICHAEL E LEE
MICHAEL D LUND
MICHAEL D RUTLEDGE
MICHAEL D GREGORY
MICHAEL L ALLAN
MICHAEL J BARTZ
MICHAEL E STERRENBURG
MICHAEL H SKRIP
MICHAEL P GOSENSKI
MICHAEL CLARK
MICHAEL RUPP
MICHAEL DEIR
MICHAEL R REICHENBACH
MICHAEL SOUDERI
MICHAEL GROSS
MICHAEL DUMAS
MICHAEL GREENSTREET
MICHAEL/DENISE MAAS
MICHEAL B WOLF
MIKE RONJOIN JR
MIKE SIRACUSE
MIKE ZUZEL
MIKE WRIGHT
MIKE VON CANNON
MIKE & KAREN STONE
MIKE DRUMMONDS
MIKE GRAHAM
MIKE RICE
MIKE KEHOE
MIKE GRAVES
MILDRED/LENORE SCHOOR
MILTON G PIERSON
MILTON/FLORENCE PETERSON
MISHEL GLASS
MITCH PATTON
MR/MRS MAURICE HEUTZENROEDER
MR/MRS JEFFREY PHILLIPS
MR/MRS PATRICK CARMAN
MR & MRS JACK WINTERS
MR/MRS JAMES L MCMULLEN
MRS ELDON R WIMER
MRS GERALD H LANGE
MUGGINS PETERS
N J KIRKMIRE
NADINE BRANOMSA
NADINE HARRANG
NADYA ROGERS
NANCI KLINGER
NANCY ROEDER
NANCY L FRENCH
NAOMI K SCHROCK
NED STONE
NEVA HASSANEIN
NIELS WEST
NILES JOKELA
NORM MARSH
NORM SWORDS
NORM WINGERD
NORMA M JONES
NORMAN RIVIERE
NORMAN R PENDELL
NORTON W BELL
OLIVER JOHNSON
ORVAL R LAYTON
OSCAR L MCALLISTER
P R LOE
PAMELA STONER
PAT BURNS
PAT TONE
PATRICIA LOVELAND
PATRICIA RASCO
PATRICIA R KELLOGG
PATRICIA LEE
PATRICK GRIFFIN
PATRICK GULLEDGE
PATTI LOWRY
PAUL E LEDER
PAUL C VIETZKE
PAUL ROOD
PAUL H CHRISTMAN
PAUL E STARK
PAUL H EGAN
PAUL L DUNCAN
PAUL FINN
PAUL PORCH
PAUL JOHNSON
PAUL HENNINGER
PAUL R BOEHNER
PAULA M DAUBIN
PEGGY BRUTON
PETE KNUTZEN
PETE ZWANEVELD
PETER WETHERWAX
PETER MORRISON
PETER MENNEN
PETER G WILLIAMS
PETER ZECH
PETER J DOWNEY
PETER DAVIS
PETER HARRELL
PETER MARTIN III
PETER LIST
PHILIP VANNUCCI
PHILLIP SCHNEIDER
PHILLIP D COBLENTZ
PHYLLIS BAXTER
PHYLLIS JAHN-POSEKANY
PRISCILLA CARLSON
QUENTIN BORBA
QUINTEN R WYLAND
R M COCKRILL
R M HERMES
R L ZWIENER
R L CRIST
R M SHEFFER
R M MCCOLLUM
R S SUND
R JOLLEY

R E BARTELL JR
R J ADAMEK
R F MARTIN
RACHEL GOODMAN
RACHEL C KARNO
RALPH FOSTER
RALPH MODINE
RALPH ZUSMAN
RALPH L KNAUSS
RALPH REID JR
RANDAL O TOOLE
RANDY ZUSTIAK
RAY C DAVIS
RAYMOND H ANDREU
RAYMOND E KELLY
RAYMOND L JERLAND
RAYMOND CROSS
RAYMOND C WILSON
REED NOSS
REEVE L HENNION
REGINA MCBRIDE
RICH FAIRBANKS
RICHARD B WORTHEY
RICHARD A CAMPBELL
RICHARD SCHRAMM
RICHARD WILLIAMS
RICHARD PLUMMER
RICHARD K SPRING
RICHARD J STANEWICK
RICHARD E BLAKE
RICHARD E MARQUARDT
RICHARD J BOYLAN
RICHARD L BARNES
RICHARD BEMENT
RICHARD ANDERSON
RICHARD BONN
RICHARD L GIBSON
RICHARD ADAMS
RICHARD MORRISON
RICHARD MESSENGER
RICHARD HASBROUCK
RICHARD BUCKBERG
RICHARD HANSEN
RICHARD HARRINGTON
RICHARD L CANTWELL
RICK SAWYER
RICK CRAWFORD
RICK SOHN
RICK PRAIRIE
RICK LUTKEMEIER
ROB LEWIS
ROBERT E MILLER JR
ROBERT F WILLEY
ROBERT E WILLE
ROBERT G LATHROP
ROBERT C BENAFEL
ROBERT C GARDNER
ROBERT D BOONE
ROBERT C MOUNTJOY
ROBERT A LONG
ROBERT L HAMM
ROBERT L SARINA III
ROBERT K SHAFFAR
ROBERT M CRICHTON
ROBERT G MILLER
ROBERT G SCRAFFORD
ROBERT H SANDER
ROBERT G WARD
ROBERT R ELLIOTT
ROBERT BARTON
ROBERT BODINE
ROBERT V CROWELL
ROBERT FERARU
ROBERT FRESCURA
ROBERT R PLUID
ROBERT R WEAVER
ROBERT R VANORDEN JR
ROBERT & JULIE WATTEZ
ROBERT SMITH
ROBERT A CARTHELL
ROBERT NUNES
ROBERT TURNER
ROBERT HARTMANN
ROBERT LECARTER
ROBERT NISBET
ROBERT MAUS
ROBERT R MUSCI
ROBIN DAVIS
ROBYN M BAIN
ROD BEACH
ROD SABIN
ROD THOMPSON
ROGER GARRETT
ROGER REDFERN
ROGER F GOLDSMITH
ROGER DROSD
RON MANGIS
RON DOWNING
RON SADLER
RON & JOANN TORO
RON BRUNSON
RONALD MILLER
RONALD S YOCKIM
RONALD W BYRD
RONALD BENTLEY
ROSCOE & WILMA POLAND
ROSE D GOSS
ROSE M LAPORTA
ROSE M OWENS
ROSEMARY HOWLEY
ROSS BURGESS
ROSS A YOUNGBLOOD
ROWLAND M ORUM
ROY SIGFRIDSON
ROY K WRIGHT
ROY ELMGREN
ROY L MILLER
ROY WINCHELL
RUDI BECKING
RUDY JUUL
RUSS MCCURDY
RUTH WILSON
RUTH L LOVE
SALLY & ROGER SCHEUSNER
SALLY K BORTH
SALLY-ANGE SNYDER
SAM BRIDENSTINE
SAM FREAR
SAMUEL C PORTER
SANDY BERRY
SARA LEIGH WILSON
SARA TOWER
SARA A LEIMAN
SARAH H WOOD
SCOTT E PRINGLE
SCOTT WADDINGTON
SCOTT BRAYTON
SCOTT BROWN
SCOTT STRAYHAN
SETH O ZWETZ
SHAHRAM SEYE DIN-NOOR
SHAUN CALLAHAN
SHAWN MILLER
SHAWN WINKLER
SHERMAN D ANDERSON
SHIRLEY SCHWARTZ
SHIRLEY A MELLOR
SIDNEY P SPAULDING
SKIP ZAPFFE
SOPHIA WONG
STAN SOLOMON
STANTON A COOK
STEPHEN R MANCE
STEPHEN L WELTY
STEPHEN W HAGER
STEPHEN BENNER
STEVE SALTER
STEVE SHORT
STEVE RIEDE
STEVE SIMPSON
STEVE SOUDER
STEVE BASKAUF
STEVE NESS
STEVE MCKENNA
STEVEN L HUFFORD
STEVEN J BERRY
STEVEN M SPEICH
STEVEN DURBIN
STEWART ALLEN
STUART SHAYNE
SUE BUSE
SUSAN WEALE
SUSAN SAUL
SUSAN M TREU
SUSAN R BOVERMAN
SUSAN CHAPP
SUSAN MORGAN
SUSAN HANSCOM
SUZY LIEBENBERG
T W ROWLETT
T JOE ZAROSINSKI
T R & W L MURRAY
TED KLASEEN
TED HOLLAND

TENNORA ADAMS
TERRY G O’NEALL
TERRY CHURCH
THAD SPRINGER
THELMA NORCROSS
THEODORE W REGIER
THEODORE KAN
THOMAS J WESELOH
THOMAS J CONWAY
THOMAS H JOHNSON
THOMAS R SHIOLAS
THOMAS L HALEY
THOMAS R COSTELLO
THOMAS S STERLING
THOMAS GRANNEMAN
THOMAS HUNTER
THOMAS BURDGE
THOMAS A OKEEFE
THOMAS A BASL
THOMAS KAIN
THOMAS A ANGENENT
TIM KESINNGER
TIM GRANT
TIM RAMIREZ
TIM SCULLEN
TIM J SCHMIDT
TIM BAILEY
TOBY R BROWN
TODD L WILKINSON
TODD GILDERSLEEVE
TOM MCADAMS
TOM TUNGATE
TOM LAWLER
TOM JOHNSTON
TOM & LORRAINE WARLICK
TOM WARD
TOM WOLFORD
TOM H DAVIS
TOM PANSKY
TOM ADAMS
TOM INFUSINO
TOM ENGSTROM
TOM BARBOULETOS
TONY HURLIMAN
TRACEY MAY
TRAVIS M TYRRELL
TRAVIS/KRISTEN ROBBINS
TROY DYMOCK
VAL PAYNE
VALERIE MILLER
VALLERIE FARSTER
VERNA R HERSHBERGER
VERNE & CLARA TERWILLIGER
VERNON L NEUSTEL
VICKI & WILLIAM CARAWAY
VICTOR U BUENZLE
VICTOR VERSTEEG
VINCE FLOYD
VIRGIL G HODGES
VIRGINIA LEMON
VIRGINIA LEE KOSKO
W PEARCY
WADE SEMELISS
WALLACE T HOBSON
WALT GRAY
WALTER C BROG
WALTER STIPE
WALTER SMITH
WARREN W MONROE
WENDELL WOOD
WESLEY ALL
WILLIAM TURNER
WILLIAM & NADIA SCHULTZ
WILLIAM A CARSTENS
WILLIAM F BARNUM
WILLIAM F BEAMER
WILLIAM E MULVIHILL
WILLIAM E GLABAU
WILLIAM H RASBAND
WILLIAM H HUPPE
WILLIAM J HUMPHREYS JR
WILLIAM B GREENE
WILLIAM D SAGASER
WILLIAM A SAILY
WILLIAM E DENNIS
WILLIAM E CORNELL
WILLIAM E BURGESS
WILLIAM PILHOFER
WILLIAM W KEYE
WILLIAM R WELCH
WILLIAM W PATTON
WILLIAM J POITRAS
WILLIAM L HOUSEHOLDER
WILLIAM R DEJAGER
WILLIAM P DIER
WILMA ROGERS
WINIFRED E O’CONNOR
YEVONNE M MONTOYA
YVONNE CARDEMIL
YVONNE BOYER-BERG

# INDEX

Adaptive Management, 2-7
Adaptive Management Areas, 2-41, 3&4-106
Administratively Withdrawn, 2-13, 2,19, 3&4-14
Adverse and Long-Term Consequences, 3&4-139
Air Quality, 3&4-118
Allowable Sale Quantity, 3&4-106, 3&4-133
Alternative - Preferred *(See Preferred Alternative)*
Alternative - No Action *(See No-Action Alternative)*
Alternatives - Comparison of Effects, 2-48
Alternatives - Eliminated from Detailed Study, 2-46
Alternatives - Standards and Guidelines, 2-18, 2-20
Amphibians and Reptiles, 3&4-21, 3&4-31, 3&4-84
Aquatic Ecosystems, 3&4-22, 3&4-47, 3&4-95
Arthropods, 3&4-18, 3&4-78
Bald Eagle, 3&4-57, 3&4-87
Bats, 3&4-21, 3&4-92
Birds, 3&4-21, 3&4-31, 3&4-87
Bryophytes, 3&4-18, 3&4-31, 3&4-63
Bureau of Land Management - Draft Resources Management Plans, 2-7, 2-10
Bureau of Land Management - Revised Preferred Alternative, Appendix B
California, 2-10, 2-12, 3&4-11, 3&4-28, 3&4-105, 3&4-110, 3&4-132, Appendix D
Commercial Fisheries Resources, 3&4-116
Consultation, 2-4
Court - Identified Defects, 3&4-102
Critical Habitat, 2-4
Cummulative Impacts, 3&4-2
Designated Area, 2-13, 3&4-39
Employment, 2-3, 3&4-105, 3&4-119, 3&4-125
Forest Ecosystem Management Assessment Team Report, Appendix A
Forest Service Plans, 2-6, 2-10
Fungi, 3&4-18, 3&4-31, 3&4-65
Government Revenues, 3&4-128
Incomplete or Unavailable Information, 3&4-2
Implementation, 2-7, 2-8, Appendix E
Interagency Scientific Committee, 2-14
Invertebrates, 3&4-18, 3&4-78
Issues, 2-2
Late-Successional Associated Species, (See Species Closely Associated with late-successional forests
Late-Successional Forest, 2-15, 2-19, 3&4-29, 3&4-39, 3&4-41, 3&4-57
Lichens, 3&4-18, 3&4-31, 3&4-69
Mammals, 3&4-21, 3&4-31, 3&4-90
Marbled Murrelet, 2-17, 3&4-9, 3&4-29, 3&4-61
Mineral Resources, 3&4-112, 3&4-113
Mitigation, 3&4-45, 3&4-46, 3&4-50, 3&4-51, 3&4-55, 3&4-56, 3&4-57, 3&4-61, 3&4-62, 3&4-64, 3&4-67, 3&4-71, 3&4-76, 3&4-80, 3&4-83, 3&4-87, 3&4-89, 3&4-92, 3&4-94, 3&4-100
Mollusks, 3&4-31, 3&4-80

Monitoring, 2-7
Native Americans, 3&4-138
No Action Alternative, 2-9, 2-19
Nonfederal Lands, 2-6, 3&4-3, 3&4-27, 3&4-38, 3&4-61, 3&4-62, 3&4-72, 3&4-77, 3&4-80, 3&4-84, 3&4-90, 3&4-94, 3&4-101, 3&4-110, Appendix D
Northern Spotted Owl, 3&4-9, 3&4-29, 3&4-58
Old-Growth Forest, 3&4-5, 3&4-16, 3&4-30, 3&4-39
Oregon, 3&4-9, 3&4-28, 3&4-105, 3&4-110, 3&4-131
Physiographic Provinces, 3&4-6
Planning Area, 2-4, 3&4-3
Preferred Alternative, 2-1, 2-43, 3&4-139
Private Lands - *(See nonfederal)*
Purpose of the Proposed Action, 1-3
Range/Grazing Resources, 3&4-115
Recovery Plan for the Northern Spotted Owl, 2-14, 3&4-58
Recreation Resources, 3&4-116
Reserves, 2-14
Rural Communities, 3&4-130
Scenic Quality, 3&4-118
Scientific Analysis Team Report, 2-15
Scoping, 1-3, Appendix A, Appendix C
Special Forest Products, 3&4-115
Species Closely Associated with late-successional forests, 3&4-29
Terrestrial Forest Ecosystems, 3&4-63
Threatened, Endangered and Proposed Species, 3&4-50
Timber Harvest, (See Also ASQ), 3&4-106, 3&4-119
Vascular Plants, 3&4-18, 3&4-31, 3&4-72
Washington, 3&4-8, 3&4-29, 3&4-105, 3&4-110, 3&4-132, Appendix D

# GLOSSARY

*Definitions in this glossary followed by the term FEMAT are taken directly from Chapter IX, Glossary, of the Forest Ecosystem Management Assessment Team's report,* Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. *This report constitutes Appendix A of this Draft SEIS.*

**50-11-40 Rule -** One of the standards and guidelines of the Interagency Scientific Committee strategy designed to provide dispersal habitat for northern spotted owls on lands outside reserves. Calls for maintaining 50 percent of forested land within each quarter township (9 square miles) in forested condition with stands of trees averaging at least 11 inches diameter at breast height and with a stand canopy closure of at least 40 percent. FEMAT

**Abiotic** - Referring to the absence of living organisms.

**Accretion** - The process, driven by plate tectonics, whereby the continental margin grows by addition of ocean crust and sediments at a subduction zone. FEMAT

**Adaptive Management -** The process of implementing policy decisions as scientifically driven management experiments that test predictions and assumptions in management plans, and using the resulting information to improve the plans. FEMAT

**Adaptive Management Areas -** Landscape units designated for development and testing of technical and social approaches to achieving desired ecological, economic, and other social objectives. FEMAT

**Administratively Withdrawn Areas -** Areas removed from the suitable timber base through agency direction and land management plans. FEMAT

**Age Class -** A management classification using the age of a stand of trees. FEMAT

**Allowable Sale Quantity (ASQ) -** The gross amount of timber volume, including salvage, that may be sold annually from a specified area over a stated period in accordance with management plans of the Forest Service or Bureau of Land Management. Formerly referred to as "allowable cut." FEMAT

**Alluvial** - Originated through the transport by and deposition from running water. FEMAT

**Alternative -** One of several policies, plans, or projects proposed for making decisions. FEMAT

**Anadromous Fish -** Fish that are born and rear in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Salmon, steelhead, and shad are examples. FEMAT

**Arthropods** - Invertebrates belonging to the largest animal phylum (over 800,000 species) including crustaceans, insects, centipedes and arachnids. Characterized by a segmented body, jointed appendages and an exoskeleton composed of chitin.

**Associated Species** - A species found to be numerically more abundant in a particular forest successional stage or type compared to other areas. FEMAT

**At-risk Fish Stocks** - Stocks of anadromous salmon and trout that have been identified by professional societies, fish management agencies, and in the scientific literature as being in need of special management consideration because of low or declining populations. FEMAT

**Banding** - To mark with a band for identification.

**Biological Diversity** - The variety of life forms and processes, including a complexity of species, communities, gene pools, and ecological functions. FEMAT

**Biomass** - The total quantity (at any given time) of living organisms of one or more species per unit of space (species biomass), or of all the species in a biotic community (community biomass). FEMAT

**Buffer** - As specifically defined in the FEMAT Report, used in the context of marbled murrelet standards and guidelines: a forested area located adjacent to suitable (nesting) marbled murrelet habitat that reduces dangers of having sharply contrasting edges of clearcuts next to such habitat Dangers include risk of wind damage to nest trees and young, increased predation, and loss of forest interior conditions.

**Bryophytes** - Plants of the phylum Bryophyta, including mosses, liverworts and hornworts, characterized by the lack of true roots, stems and leaves.

**Bureau of Land Management (BLM) Administered Lands** - Oregon and California railroad lands (O&C), Public Domain (PD), Coos Bay Wagon Road (CBWR), acquired lands, and split estate (Federal Minerals).

**Candidate Species** - Those plants and animals included in Federal Register "Notices of Review" that are being considered by the Fish and Wildlife Service for listing as threatened or endangered. Two categories that are of primary concern: Category 1 - Taxa for which there is substantial information to support proposing the species for listing as threatened or endangered. Listing proposals are either being prepared or have been delayed by higher priority listing work. Category 2 - Taxa information indicates that listing is possibly appropriate. Additional information is being collected. FEMAT

**Canopy Closure** - The degree to which the canopy (forest layers above one's head) blocks sunlight or obscures the sky. It can only be accurately determined from measurements taken under the canopy as openings in the branches and crowns must be accounted for. FEMAT

**Cavity Nester -** Wildlife species, most frequently birds, that require cavities (holes) in trees for nesting and reproduction. FEMAT

**Closely Associated Species -** A species is designated as "closely associated" with a forest successional stage if the species is found to be significantly more abundant in that forest successional stage compared to the other successional stages, if it is known to occur almost exclusively in that successional stage, or if it uses habitat components that are usually produced at that stage. FEMAT

**Cluster -** An area that contains habitat capable of supporting three or more breeding pairs of spotted owls with overlapping or nearly overlapping home ranges. FEMAT

**Coarse Woody Debris (CWD) -** Portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20 inches in diameter. FEMAT

**Code of Federal Regulations (CFR)** - A codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal government. FEMAT

**Commercial Thinning** - The removal of generally merchantable trees from an even-aged stand, usually to encourage growth of the remaining trees (see definition of Even-aged Silviculture in the glossary in Appendix A). FEMAT

**Conferencing** - Informal discussion or correspondence consultation that takes place between the U.S. Fish and Wildlife Service and another Federal agency when it is determined that a proposed Federal action may jeopardize the continued existence of a species proposed as threatened or endangered or result in adverse modification of proposed critical habitat. FEMAT

**Congressionally** Withdrawn Areas - Areas that require Congressional enactment for their establishment, such as National Parks, Wild and Scenic Rivers, National Recreation Areas, National Monuments, and Wilderness. FEMAT. These are also referred to as Congressional Reserves.

**Connectivity** - A measure of the extent to which conditions among LS/OG forest areas provide habitat for breeding, feeding, dispersal, and movement of LS/OG-associated wildlife and fish species (see LS/OG Forest). FEMAT

**Consultation -** A formal interaction between the U.S. Fish and Wildlife Service and another Federal agency when it is determined that the agency's action may affect a species that has been listed as threatened or endangered or its critical habitat. FEMAT

**Cover** - Vegetation used by wildlife for protection from predators, or to mitigate weather conditions, or to reproduce. May also refer to the protection of the soil and the shading provided to herbs and forbs by vegetation. FEMAT

**Critical Habitat** - Under the Endangered Species Act, critical habitat is defined as (1) the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protection; and (2) specific areas outside the geographic area occupied by a listed species, when it is determined that such areas are essential for the conservation of the species. FEMAT

**Cumulative Effects** - Those effects on the environment that result from the incremental effect of the action when added to the past, present, and reasonably foreseeable future actions regardless of what agency (Federal or nonfederal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. FEMAT

**Debris Flow** - A rapid moving mass of rock fragments, soil, and mud, with more than half of the particles being larger than sand size.

**Debris Slide** - A slow to rapid slide, involving downslope translation of relatively dry and predominantly unconsolidated materials, with more than half of the particles being larger than sand size. FEMAT

**Debris Torrent** - Rapid movement of a large quantity of materials (wood and sediment) down a stream channel during storms or floods. This generally occurs in smaller streams and results in scouring of streambed.

**Decay Class** - See **Log Decomposition Class.**

**Decommission** - To remove those elements of a road that reroute hillslope drainage and present slope stability hazards. Another term for this is "hydrologic obliteration." FEMAT

**Demography** - The quantitative analysis of population structure and trends; population dynamics. FEMAT

**Designated Conservation Area (DCA)** - A contiguous area of habitat to be managed and conserved for spotted owls under the Final Draft Recovery Plan for the Northern Spotted Owl. This general description can be applied to two DCA categories: DCA 1 - Category intended to support at least 20 pairs of spotted owls. DCA 2 - Category intended to support one to 19 pairs of spotted owls. FEMAT

**Detritivores** - Organisms that feed on dead animals or partially decomposed organic matter.

**Direct Effects for Employment and Income** - Those effects that impact sectors either exporting processed wood products from the economic area or selling those products to final consumers. An example of direct employment would be people working in a sawmill.

**Dispersal Habitat -** Habitat that supports the life needs of an individual animal during dispersal. Generally satisfies needs for foraging, roosting, and protection from predators. FEMAT

**Dissected -** Cut by erosional processes into hills and valleys, or into flat interstream areas and valleys. FEMAT

**District** - An administrative unit within the Bureau of Land Management.

**Disturbance** - A force that causes significant change in structure and/or composition through natural events such as fire, flood, wind, or earthquake, mortality caused by insect or disease outbreaks, or by human-caused events, elg., the harvest of forest products. FEMAT

**Drainage -** An area (basin) mostly bounded by ridges or other similar topographic features, encompassing part, most, or all of a watershed and enclosing some 5,000 acres (see Subdrainage and Forest Watershed). FEMAT

**Duff Layer -** As specifically defined in the FEMAT Report, the layer of loosely compacted debris underlying the litter layer on the forest floor.

**Early-Successional Forest** - Forest seral stages younger than mature and old-growth age classes.

**Earthflow** - A mass-movement landform and slow to rapid process characterized by downslope translation of soil and weathered rock over a discrete shear zone at the base, with most of the particles being smaller than sand. FEMAT

**Eastside -** Generally, east of the crest of the Cascade Range.

**Ecosystem Approach -** As defined by the Forest Ecosystem Management Assessment Team: A strategy or plan to manage ecosystems to provide for all associated organisms, as opposed to a strategy or plan for managing individual species.

**Effects** - Effects, impacts, and consequences, as used in this environmental impact statement, are synonymous. Effects may be direct, indirect or cumulative and may fall in one of these categories: aesthetic, historic, cultural, economic, social, health or ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems).

**Endangered Specie**s - Any species of plant or animal defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range, and published in the Federal Register. FEMAT

**Endemic** - A species that is unique to a specific locality. FEMAT

**Environmental Analysis** - An analysis of alternative actions and their predictable short-term and long-term environmental effects, incorporating physical, biological, economic, and social considerations. FEMAT

**Environmental Assessment (EA) -** A systematic analysis of site-specific activities used to determine whether such activities have a significant effect on the quality of the human environment and whether a formal environmental impact statement is required; and to aid an agency's compliance with the National Environmental Policy Act when no environmental impact statement is necessary. FEMAT

**Ephemeral Streams -** Streams that contain running water only sporadically, such as during and following storm events. FEMAT

**Epizootic -** Outbreak of disease (an epidemic) in a population of non-human animals.

**Even-Aged Management -** A silvicultural system which creates forest stands that are primarily of a single age or limited range of ages. Creation of even-aged stands may be accomplished through the clearcut, seed tree or shelterwood methods.

**Extirpation -** The elimination of a species from a particular area. FEMAT

**Fauna -** The animal life of a region or geological period.

**Fault -** A break or shear in the continuity of a body of rock on which there has been an observable displacement of the two parts. FEMAT

**Fecundity** - Number of female young produced per adult female in the population of interest. FEMAT

**Federal Land Policy and Management Act (FLPMA)** - A law passed in 1976 applying to the Bureau of Land Management directing the management of lands administered by that agency including the requirement to develop land use plans and prepare regulations to guide that development.

**Final Environmental Impact Statement (FEIS) -** The final report of environmental effects of proposed action on an area of land. This is required for major federal actions under Section 102 of the National Environmental Policy Act. It is a revision of the draft environmental impact statement to include public and agency responses to the draft. FEMAT

**Floodplain** - Level lowland bordering a stream or river onto which the flow spreads at flood stage. FEMAT

**Food Web -** A modified food chain that expresses feeding relationships at various, changing trophic levels.

**Flora** - The plant life of a region or geological period.

**Forest land** - Land that is now, or is capable of becoming, at least 10 percent stocked with forest trees and that has not been developed for nontimber use. FEMAT

**Forest Types** - A classification of forest land based on the tree species presently forming a plurality of basal area stocking or crown cover of live trees.

**Forest Watershed** - The forested drainage area contributing water, organic matter, dissolved nutrients, and sediments to a lake or stream. FEMAT

**Fractured** - A rock mass separated into distinct fragments. FEMAT

**Fragmentation** - The process of reducing size and connectivity of stands that compose a forest. FEMAT

**Fuel Loading** - The amount of combustible material present per unit of area, usually expressed in tons per acre. FEMAT

**Geomorphic** - Pertaining to the form or shape of those processes that affect the surface of the earth. FEMAT

**Granitic** - Any light-colored, coarse-grained rock formed at considerable depth by crystallization of molten rock. FEMAT

**Green Tree Retention** - A stand management practice in which live trees as well as snags and large down wood are left as biological legacies within harvest units to provide habitat components over the next management cycle. There are two levels:

**High level** - A regeneration harvest designed to retain the highest level of trees possible while still providing enough disturbance to allow regeneration and growth of the naturally occurring mixture of tree species. Such harvest should allow for the regeneration of intolerant and tolerant species. Harvest design would also retain cover and structural features necessary to provide foraging and dispersal habitat for mature and old-growth dependant species.

**Low level** - A regeneration harvest designed to retain only enough green trees and other structural components (snag, coarse woody debris, etc.) to result in the development of stands that meet old-growth definitions within 100 to 120 years after harvest entry, considering overstory mortality. FEMAT

**Habitat Capability** - The estimated number of pairs of spotted owls that can be supported by the kind, amount, and distribution of suitable habitat in the area. As used in the Final Draft Recovery Plan for the Northern Spotted Owl, this means the same as capability to support spotted owl pairs. FEMAT

**Habitat Conservation Area (HCA)** - As proposed by the Interagency Scientific Committee, a contiguous block of habitat to be managed and conserved for breeding pairs, connectivity, and distribution of owls. Application may vary throughout its range according to local conditions. FEMAT

**Hibernacula** - A case or covering which protects all or part of an animal or plant from extreme cold. A winter shelter for plants or dormant animals.

**High Severity Fire** - A wildfire event with acute ecological impacts; usually, but not always of high intensity. FEMAT

**Hybridization** - The crossing or mating of two different varieties of plants or animals. FEMAT

**Hypogeous** - Living or maturing below the surface of the ground (i.e., seedling cotyledons).

**Hyporheic Zone** - The area under the stream channel and floodplain that contributes to the stream. FEMAT

**Indirect Effects for Employment and Income** - Those that impact other production, trade, and service sectors that provide the production inputs needed to manufacture the processed wood products. An example of indirect employment would be people who manufacture the saw blades used in the sawmills.

**Ingrowth** - The period after successional growth of a forest stand when it reaches a specified age or structure class. For instance, spotted owl forage habitat. FEMAT

**Inner Gorge** - A stream reach bounded by steep valley walls that terminate upslope into a more gentle topography. Common in areas of rapid stream downcuttng or uplift, such as northern California and southwestern Oregon. FEMAT

**Insectivores** - Plants or animals which feed on insects.

**Interdisciplinary Team** - A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad enough to adequately analyze the problem and propose action. FEMAT

**Intermittent Stream** - Any non-permanent flowing drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria. FEMAT

**Key Watershed** - As defined by National Forest and Bureau Land Management District fish biologists, a watershed containing (1) habitat for potentially threatened species or stocks of anadromous salmonids or other potentially threatened fish, or (2) greater than 6 square miles with high-quality water and fish habitat. FEMAT

**Landscape** - A heterogenous land area with interacting ecosystems that are repeated in similar form throughout. FEMAT

**Late-Successional Forests** - Forest seral stages which include mature and old-growth age classes.

**Late-Successional Reserve** - A forest in its mature and/or old-growth stages that has been reserved under each option in this report (see Old-growth Forest and Succession). FEMAT

**Lava Flow -** A congealed stream of lava. FEMAT

**Litter Layer -** The loose, relatively undecomposed organic debris on the surface of the forest floor made up typically of leaves, bark, small branches, and other fallen material (see also Duff Layer). FEMAT

**Log Decomposition Class** - Any of five stages of deterioration of logs in the forest. Stages range from essentially sound (class 1) to almost total decomposition (class 5). FEMAT

**LS/OG Forest (or Stands)** - Late-successional and/or old growth. Forests or stands consisting of trees and structural attributes and supporting biological communities and processes associated with old-growth and/or mature forests. FEMAT

**Managed Forest -** Any forestland that is treated with silvicultural practices and/or harvested. Generally applied to land that is harvested on a scheduled basis and contributes to an allowable sale quantity. FEMAT

**Managed Late-Successional Areas -** Selected harvest areas and managed pair areas. FEMAT

**Managed Pair Areas -** In some portions of the northern spotted owl's range it is necessary to provide additional protection in the matrix for pairs of owls and territorial singles. This consists of delineating a core habitat area, plus additional acreage of suitable habitat around the core. The acreage to be delineated around the core varies throughout the range, based on data for pairs in that area. The suitable acreage must be delineated in an area equal to the mean home range for that physiographic province. Appropriate silvicultural treatment is encouraged in suitable and unsuitable habitat in the acreage around the core. FEMAT

**Management Activity -** An activity undertaken for the purpose of harvesting, traversing, transporting, protecting, changing, replenishing, or otherwise using resources. FEMAT

**Management Framework Plan (MFP) -** A land use plan that established coordinated land use allocations for all resource and support activities for a specific land area within a Bureau of Land Management District. It established objectives and constraints for each resource and support activity and provided data for consideration in program planning. This process has been replaced by the Resource Management Planning process. FEMAT

**Marbled Murrelet Zone 1 -** A 10 to 40 mile-wide zone adjacent to marine areas in which the majority of marbled murrelet detections and nests are located. FEMAT

**Marbled Murrelet Zone 2** - An inland zone that abuts marbled murrelet zone 1. Numbers of murrelet detections in zone 2 indicate that it is used by only a small fraction of the breeding population. FEMAT

**Mass Movement** - The downslope movement of earth caused by gravity. Includes but is not limited to landslides, rock falls, debris avalanches, an creep. It does not, however, include surface erosion by running water. It may be caused by natural erosional processes, or by natural disturbances (e.g., earthquakes or fire events) or human disturbances (e.g., mining or road construction). FEMAT

**Matrix** - Federal lands outside of reserves, withdrawn areas, and Managed Late-Successional areas. FEMAT

**Merchantable Trees, Stands, Timber** - Trees or stands that people will buy for the wood they contain. FEMAT

**Mesic** - Pertaining to or adapted to an area that has a balanced supply of water; neither wet nor dry. FEMAT

**Microhabitats** - A restricted set of distinctive environmental conditions that constitute a small habitat, such as the area under a log. FEMAT

**Mitigation measures** - Modifications of actions that (1) avoid impacts by not taking a certain action or parts of an action; (2) minimize impacts by limiting the degree or magnitude of the action and its implementation; (3) rectify impacts by repairing, rehabilitating, or restoring the affected environment; (4) reduce or eliminate impacts over time by preservation and maintenance operations during the life of the action; or (5) compensate for impacts by replacing or providing substitute resources or environments. FEMAT

**Monitoring** - A process of collecting information to evaluate if objective and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned. FEMAT

**Multistoried** - Forest stands that contain trees of various heights and diameter classes and therefore support foliage at various heights in the vertical profile of the stand. FEMAT

**National Environmental Policy Act (NEPA)** - An Act passed in 1969 to declare a National policy that encourages productive and enjoyable harmony between humankind and the environment, promotes efforts that prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the nation, and establishes a Council on Environmental Quality (The Principal Laws Relating to Forest Service Activities, Agric. Handb. 453. USDA Forest Service, 359 p.). FEMAT

**National Forest Management Act (NFMA)** - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring the preparation of Forest Plans and the preparation of regulations to guide that development. FEMAT

**Nesting, Roosting, and Foraging Habitat** - The forest vegetation with the age class, species of trees, structure, sufficient area, and adequate food source to meet some or all of the life needs of the northern spotted owl. FEMAT

**Neotropical -** Designating or of the biogeographic realm that includes South America, the Indies, Central America and tropical Mexico.

**Nonattainment** - Failure of a geographic area to attain or maintain compliance with National Ambient Air Quality Standards (NAAQS) as defined by the Clean Air Act (1990 revision). FEMAT

**Noncommercial Tree Species -** Minor conifer and hardwood species whose yields are not reflected in the commercial conifer forest land allowable sale quantity. Some species may be managed and sold under a suitable woodland allowable sale quantity and, therefore, may be commercial as a woodland species. FEMAT

**Nonforest Land** - Land developed for nontimber uses or land incapable of being 10 percent stocked with forest trees. FEMAT

**O&C Lands** - Public lands granted to the Oregon and California Railroad Company and subsequently revested to the United States. FEMAT

**Old-Growth Associated Species -** Plant and animal species that exhibit a strong association with old-growth forests. FEMAT

**Old-Growth Emphasis Areas (OGEA) -** In Bureau of Land Management Draft planning documents of 1992, areas where management emphasis will be given to providing for old-growth associated species and biological diversity. Management would provide for timber production when consistent with local and landscape level diversity. FEMAT

**Old-Growth Forest** - A forest stand usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground. FEMAT

**Overstory** - Trees that provide the uppermost layer of foliage in a forest with more than one roughly horizontal layer of foliage. FEMAT

**Packing** - A temporary influx of organisms of various sex and age classes into remaining suitable habitat as previously available habitat is changed to unsuitable conditions. FEMAT

**Pair Site** - An amount of habitat that is considered capable of supporting one pair of spotted owls. FEMAT

**Partial Cutting -** Removal of selected trees from a forest stand. FEMAT

**Passerine -** Pertaining to an order (Passeriformes) of small or medium-sized, chiefly perching songbirds having grasping feet with the first toe directed backward.

**Patch** - A small (20-60 acre) part of the forest. This term is often used to indicate a type of clearcutting (patch cuts) associated with the "staggered setting" approach to distributing harvest units across the landscape. FEMAT

**Perennial Stream** - A stream that typically has running water on a year-round basis. FEMAT

**Persistence** - As in population persistence, is a term for the capacity of a population to maintain sufficient numbers and distribution over time.

**Physiographic Province** - A geographic area having a similar set of biophysical characteristics and processes due to effects of climate and geology which result in patterns of soils and broad-scale plant communitites. Habitat patterns, wildlife distributions, and historical land use patterns may differ significantly from those of adjacent provinces. FEMAT

**Planning Area** - All of the lands within a Federal agency's management boundary addressed in land management plans. FEMAT

**Plateau** - A table-land of flat-topped region of considerable extent and elevation. FEMAT

**Population Viability** - Probability that a population will persist for a specified period across its range despite normal fluctuations in population and environmental conditions. FEMAT

**Precommercial Thinning** - The practice of removing some of the trees less than merchantable size from a stand so that remaining trees will grow faster. FEMAT

**Presuppression** - Activities organized advance of fire occurrence to ensure effective suppression acton and/or to minimize risk to humans and resource damage. FEMAT

**Probable Sale Quantity (PSQ)** - Probable sale quantity (PSQ) was used by the Assessment Team rather than allowable sales quantity (ASQ) to describe the allowable harvest levels for the various alterntives that could be maintained without decline over the long term if the schedule of harvests and regeneration were followed. "Allowable" was changed to "probable" to reflect some uncertainity in the calculations for the variious alternatives, for example, many of the alternatives require watershed analysis in Key Watersheds before timber harvest can occur. Estimates were made of probable sale levels using a set of interim rules for those Key Watersheds. PSQ is otherwise comparable to ASQ. PSQ includes only scheduled or regulated yields from the matrix and does not include "other wood", or volume of cull and other products that are not normally part of ASQ calculations.

**Propagule** - A reproductive structure of brown algae.

**Quarter-Township** - An area approximately 3 miles square containing nine sections of land. FEMAT

**Range of the Northern Spotted Owl** - The range of the northern spotted owl in the United States is generally comprised of lands in western Washington and Oregon, and northern California. See Figure 2-1 in Chapter 2.

**Receipts** - Those priced benefits for which money will actually be paid to the managing agency: recreation fees, timber harvest, mineral leases and special use fees.

**Record of Decision** - A document separate from but associated with an environmental impact statement that states the management decision, identifies all alternatives including both the environmentally preferable and preferred alternatives, states whether all practicable means to avoid environmental harm from the preferred alternative have been adopted, and if not, why not. FEMAT

**Recovery Plan** - A plan for the conservation and survival of an endangered species or a threatened species listed under the Endangered Species Act, to improve the status of the species to justify delisting in accordance with the Endangered Species Act.

**Reforestation** - The natural or artificial restocking of an area with forest trees; most commonly used in reference to artificial stocking. FEMAT

**Refugia** - Locations and habitats that support populations of organisms that are limited to small fragments of their previous geographic range (i.e., endemic populations). FEMAT

**Region** - A Forest Service administrative unit. The two Regions affected by this proposed action are the Pacific Northwest Region (Region 6) which includes National Forests in Oregon and Washington, and the Pacific Southwest Region (Region 5) which includes National Forests in California. FEMAT

**Regional Guide** - The guide developed to meet the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act. Regional Guides provide standards and guidelines for addressing major issues and management concerns which need to be considered at the Regional level to facilitate National Forest planning. FEMAT

**Regulations** - Generally refers to the Code of Federal Regulations. FEMAT

**Rescue Effect** - Immigration of new individuals sufficient to maintain a population that might otherwise decline toward extinction. FEMAT

**Reserved Pair Areas** - In those portions of the species' range where habitat and owl populations were inadequate to apply the criteria creating designated conservation areas, then individual pair areas were also reserved. These are areas of suitable habitat identified for pairs and territorial single owls. The acreage of these areas varies throughout the range, based on data for pairs in each physiographic province. All suitable habitat is reserved in an area equal to the mean home range for that province. FEMAT

**Research Natural Area (RNA)** - An area set aside by a public or private agency specifically to preserve a representative sample of an ecological community, primarily for scientific and educational purposes. In Forest Service usage, research natural areas are areas designated to ensure representative samples of as many of the major naturally occurring plant communities as possible. FEMAT

**Resource Management Plan (RMP) -** A land use plan prepared by an agency under current regulations in accordance with the Federal Land Policy and Management Act. FEMAT

**Riparian Area** - As specifically defined in the FEMAT Report, a geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it. This includes floodplain, woodlands, and all areas within a horizontal distance of approximately 100 feet from the normal line of high water of a stream channel or from the shoreline of a standing body of water.

**Riparian Habitat Conservation Area -** Portions of a watershed that contribute to the creation and maintenance of fish habitat. FEMAT

**Riparian Reserves -** Designated riparian areas found outside Late-Successional Reserves. FEMAT

**Riparian Zone -** As specifically defined in the FEMAT Report, those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics. Normally used to refer to the zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs, and wet meadows.

**Ripping** - The process of breaking up or loosening compacted soil (e.g., skid trails or spur roads) to better assure penetration of roots of young tree seedlings. FEMAT

**Rock Stability Groups** - Groups of rocks having similar resistance to physical and chemical weathering. These properties strongly influence rates of soil development, types of mass wasting and other erosion processes, and hydrologic and biologic processes. Groups with decreasing resistance are described as resistant, intermediate, weak, and unconsolidated.

**Rotation** - The planned number of years between regeneration of a forest stand and its final harvest (regeneration cut or harvest). A forest's age at final harvest is referred to as rotation age. In this report, an extended rotation is 120-180 years, a long rotation 180 years. FEMAT

**Roost** - The resting behavior of an animal. FEMAT

**Second Growth** - Relatively young forests that have developed following a disturbance (e.g., wholesale cutting, serious fire, or insect attack) of the previous old-growth forest. FEMAT

**Sediment Yield** - The quantity of soil, rock, particles, organic matter, or other dissolved or suspended debris is transported through a cross-section of stream in a given period. Measured in dry weight or by volume. Consists of dissolved load, suspended load, and bed load. FEMAT

**Seeps** - Places where water oozes from the ground to form a pool.

**Selection Cutting** - a method of uneven-aged management involving the harvesting of single trees from stands (single-tree selection) or in groups (group selection) without harvesting the entire stand at any one time. FEMAT

**Sensitive Species** - Those species that (1) have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species or (2) are on an official state list or (3) are recognized by the U.S. Forest Service or other management agency as needing special management to prevent their being placed on Federal or state lists. FEMAT

**Seral Stages** - The series of relatively transitory planned communities that develop during ecological succession from bare ground to the climax stage. FEMAT

**Serpentine Soils** - Soils developed on altered ultramafic rocks. FEMAT

**Serpentinite/Peridotite** - The association of dark-colored, coarse-grained, iron and magnesium-rich igneous rock (peridotite) with the products of hydrothermal alteration and faulting of these rocks (serpentinite). FEMAT

**Shelterwood** - A regeneration method under an even-aged silvicultural system. A portion of the mature stand is retained as a source of seed and/or protection during the period of regeneration. The mature stand is removed in two or more cuttings. FEMAT

**Short List** - Refers to Appendix 5-D , "Attributes of Terrestrial (Non-Fish) Vertebrates Closely Associated With Old-Growth Forests in National Forests Within the Range of the Northern Spotted Owl ("Short List")" of the Scientific Analysis Team Report (Thomas et al. 1993).

**Silvicultural Prescription** - A professional plan for controlling the establishment, composition, constitution and growth of forests. FEMAT

**Silvicultural System** - A planned sequence of treatments or prescriptions over the entire life of a forest stand needed to meet management objectives.

**Site-Potential Tree** - A tree that has attained the average maximum height possible given site conditions where it occurs. FEMAT

**Slope Stability** - The resistance of a natural or artificial slope or other inclined surface to failure by landsliding (mass movement). FEMAT

**Snag** - Any standing dead, partially dead, or defective (cull) tree at least 10 inches in diameter at breast height and at least 6 feet tall. A hard snag is composed primarily of sound wood, generally merchantable. A soft snag is composed primarily of wood in advanced stages of decay and deterioration, generally not merchantable. FEMAT

**Soil Productivity** - Capacity or suitability of a soil, for establishment and growth of a specified crop or plant species, primarily through nutrient availability. FEMAT

**Spotted Owl Additions** - Areas of LS/OG or suitable spotted owl habitat or potential owl habitat added to most significant LS/OG forest (LS/OG1) to ensure compliance with the Interagency Scientific Committee Strategy. FEMAT

**Stand (Tree Stand)** - An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition so that it is distinguishable from the forest in adjoining areas. FEMAT

**Standards and Guidelines** - The primary instructions for land manager. Standards address mandatory actions, while guidelines are recommended actions necessary to a land management decision. FEMAT

**State Implementation Plan (SIP)** - A state document, required by the Clean Air Act. It describes, a comprehensive plan of action for achieving specified air quality objectives and standards for a particular locality or region within a specified time, as enforced by the state, and approved by the Environmental Protection Agency. FEMAT

**Stocked/Stocking** - The degree an area of land is occupied by trees as measured by basal area or number of trees. FEMAT

**Structural Diversity** - The diversity of forest structure, both vertical and horizontal, that provides for a variety of forest habitats for plants and animals. The variety results from layering or tiering of the canopy and the die-back, death, and ultimate decay of trees. In aquatic habitats, the presence of a variety of structural features such as logs and boulders that create a variety of habitat. FEMAT

**Subadult** - A young, spotted owl that has dispersed but not yet reached breeding age. Subadults are in their second, or in some cases, third year of life. FEMAT

**Subdrainage -** A land area (basin) bounded by ridges or similar topographic features, encompassing only part of a watershed, and enclosing on the order of 5,000 acres; smaller than, and part of, a watershed. (See Drainage and Forest watershed.) FEMAT

**Subspecies** - A population of a species occupying a particular geographic area, or less commonly, a distinct habitat, capable of interbreeding with other populations of the same species. FEMAT

**Substrate** - Any object or material upon which an organism grows or is attached.

**Succession** - A series of dynamic changes by which one group of organisms succeeds another through stages leading to potential natural community or climax. An example is the development of series of plant communities (called seral stages) following a major disturbance. FEMAT

**Surface Erosion** - A group of processes whereby soil material are removed by running water, waves and currents, moving ice, or wind. FEMAT

**Sustained Yield -** The yield that a forest can produce continuously at a given intensity of management. FEMAT

**Take** - Under the Endangered Species Act, take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect an animal, or to attempt to engage in any such conduct. FEMAT

**Talus** - A slope landform, typically covered by coarse rock debris forming a more or less continuous layer that may or may not be covered by duff and litter. FEMAT

**Taxon** - A category in scientific classification system, such as class, family, or phylum. FEMAT

**Territory** - The area that an animal defends, usually during breeding season, against intruders of its own species. FEMAT

**Threatened Species** - Those plant or animal species likely to become endangered species throughout all or a significant portion of their range within the foreseeable future. A plant or animal identified and defined accordance with the 1973 Endangered Species Act and published in the Federal Register. FEMAT

**Threshold Phenomenon** - Pattern or trend in population growth rate that exhibits relatively long periods of slow change followed by precipitous increase or response to an environmental gradient. FEMAT

**Timber Management** - A general term for the directing, managing or controlling of forest crops and stands of trees.

**Timber Production** - The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use other than for fuelwood. FEMAT

**Torpor -** A state of being dormant or inactive.

**Township -** A unit of territory, generally six miles square, containing 36 mile-square sections.

**Ultramafic** - Dark-colored igneous rocks composed of minerals which are enriched in iron and magnesium. (See Serpentinite/periodotite.) FEMAT

**Unconsolidated Deposits** - Sediments that are loosely arranged, with particles that are not cemented together. Includes alluvial, glacial, volcanic, and landslide deposits. FEMAT

**Underburning** - Prescribed burning of the forest floor or understory for botanical or wildlife habitat objectives, hazard reduction, or silvicultural objectives. FEMAT

**Understory** - The trees and other woody species growing under the canopies of larger adjacent trees and other woody growth. FEMAT

**Uneven-aged Management -** A combination of actions that simultaneously maintains continuous tall forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection. FEMAT

**Ungulate** - A hoofed mammal.

**Uplift** - A structurally high area in the earth's crust, produced by positive movements that raise or upthrust the rocks. FEMAT

**Viability** - The ability of a wildife or plant population to maintain sufficient size so that is persists over time in spite of normal fluctuations in numbers; usually expressed as a probability of maintaining a specific population for a specified period. FEMAT

**Viable Population -** A wildlife or plant population that contains an adequate number of reproductive individuals appropriately distributed on the planning area to ensure the long-term existence of the species. FEMAT

**Water Quality** - The chemical, physical, and biological characteristics of water. FEMAT

**Watershed** - The drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a stream or lake. FEMAT

**Watershed Analysis** - A systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives. Watershed analysis is a stratum of ecosystem management planning applied to watersheds of approximately 20 to 200 square miles. FEMAT

**Westside -** Generally, west of the crest of the Cascade Range.

**Wetlands** - Areas that are inundated by surface water or ground water with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetative or aquatic life that require saturated or seasonally saturated soil conditions for growth and reproduction (Executive Order 11990). Wetlands generally include, but are not limited to, swamps, marshes, bogs, and similar areas. FEMAT

**Wild and Scenic River System -** Those rivers or section of rivers designated as such by Congressional action under the Wild and Scenic River Act (Public Law 90-542, 1968), as supplemented and amended, or those sections of rivers designated as wild, scenic, or recreational by an act of the legislature of the state or states through which they flow. FEMAT

**Wilderness** - Areas designated by Congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped Federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres or are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, education, scenic, or historical value as well as ecologic and geologic interest. FEMAT

**Windthrow -** A tree or trees uprooted or felled by the wind. FEMAT

**Woody Debris -** See **Coarse Woody Debris.**

# REFERENCES

Babbitt, B., Secretary of the Interior. 1993. Letter dated April 19 to Michael J. Penfold, Acting Director, Bureau of Land Management, acknowledging BLM's withdrawal of the exemption application for 13 timber sales. 1 p.

Bibles, D.D. 1992. Letter dated October 2 to Jerald Hutchins. Bureau of Land Management's response concerning approved current management plan and contribution to spotted owl habitat and numbers. On file with: Spotted Owl EIS Team, USDA Forest Service, P.O. Box 3623, Portland, OR 97023. 2 p.

Espy, M.; Babbitt, B. 1993a. Declaration made April 22 to the United States District Court for the Western District of Washington. 3 p.

Espy, M.; Babbitt, B. 1993b. Memo dated May 12, 1993, for the Chief of the Forest Service and Director of the Bureau of Land Management re: SEIS on Forest Conference Alternatives. 2p.

Johnson, K.N.; Franklin, J.F.; Thomas, J.W.; Gordon, J. 1991. Alternatives for management of late-successional forests of the Pacific Northwest. A report to the Agriculture Committee and the Merchant Marine Committee of the U.S. House of Representatives. 59 p.

Laymon, S.A.; Salwasser, H.; Barrett, R.H. 1985. Habitat suitability index models: spotted owl. Biological Report 82(10.113). Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. 13 p.

Lowe, J.E. 1993. Letter dated 28 January to Forest Supervisors managing marbled murrelet habitat. 2670: New limitations on future action for marbled murrelet protection. 2 p.

Mays, L.K.; Mulder, B.S. 1991. Letter dated April 30 with memo entitled, Responses to questions pertaining to interpretation and implementation of the Interagency Scientific Committee Conservation Strategy. Answers to questions in memo provided by members of the Technical Review Team of the Interagency Northern Spotted Owl Conservation Group (INSOCG).

Neitro, W.A.; Binkley, V.W.; Cline, S.P. [and others]. 1985. Pages 130-164 in: Brown, E.R., tech. ed. Management of wildlife and fish habitats in forests of western Oregon and Washington. Portland, OR: USDA Forest Service, Pacific Northwest Region. In cooperation with: USDI Bureau of Land Management.

Penfold, M.J., Acting Director, USDI Bureau of Land Management. 1993. Letter dated April 19 to Secretary of the Interior Bruce Babbitt stating the BLM's decision to withdraw its application for exemption from the Endangered Species Act for 13 timber sales. 1 p.

Ralph, C.J.; Nelson, S.K. 1992. Methods of surveying marbled murrelets at inland forested sites. Pacific Seabird Group, Marbled Murrelet Technical Committee. 21 p. Unpublished Report.

Renwald, J.D. 1993. Personal communication. Portland, OR: U.S. Department of the Interior, Bureau of Indian Affairs.

Stewart, R.E. 1993. Letter dated 28 January to Forest Supervisors, Six Rivers, Shasta-Trinity, Los Padres, Klamath and Mendocino N.F.s. 2670/2430: New limitations on future action for marbled murrelet protection. 2 p.

Thomas, J.W. 1991. Letter dated January 3 with memo entitled, Responses to questions pertaining to interpretation and implementation of the Interagency Scientific Committee Conservation Strategy. 11 p.

Thomas, J.W.; Forsman, E.D.; Lint, J.B., [and others]. 1990. A conservation strategy for the northern spotted owl: a report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Portland, OR: U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior, Bureau of Land Management, Fish and Wildlife Service, and National Park Service. 427 p.

Thomas, J.W., Raphael, M.G.; Anthony, R.G., [and others]. 1993. Viability assessments and management considerations for species associated with late-successional and old-growth forests of the Pacific Northwest. The Report of the Scientific Analysis Team. Portland, OR: USDA Forest Service, National Forest System, Forest Service Research. 530 p.

USDA Forest Service. [Unpublished]. Port-Orford-cedar action plan. USDA Forest Service, Pacific Northwest and Pacific Southwest Regions. 9 p.

USDA Forest Service. 1988. Final supplement to the environmental impact statement for an amendment to the Pacific Northwest Regional Guide. U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. Vol. 1.

USDA Forest Service. 1991. Questions and answers on: "A conservation strategy for the northern spotted owl." Portland, OR: USDA Forest Service, Pacific Northwest Research Station. Misc. Pub. February 1991 (previously released August 3, 1990). 63 p.

USDA Forest Service. 1992. Final environmental impact statement on management for the northern spotted owl in the National Forests. Portland, OR: U.S. Department of Agriculture, Forest Service, National Forest System. 2 vols., 12 maps, 6 page errata sheet.

USDA Forest Service; USDI Bureau of Land Management; USDHHS Food and Drug Administration. 1993. Pacific yew draft environmental impact statement. Portland, OR: USDA Forest Service. 127 p.

USDI National Park Service. 1988. Management policies. Washington, DC: USDI National Park Service.

USDI Fish and Wildlife Service. 1990. Interim procedures leading to endangered species act compliance for the northern spotted owl. Portland, OR: USDI Fish and Wildlife Service. 37 p.

USDI. 1992a. Final Draft of The Northern Spotted Owl Recovery Plan. Portland, OR: U.S. Department of the Interior. 2 vols. Unpublished manuscript.

USDI. 1992b. Recovery plan for the northern spotted owl - draft. Portland, OR: U.S. Department of the Interior. 662 p.

USDI Bureau of Land Management. 1992c. Draft Coos Bay District resource management plan & EIS. Coos Bay, OR: U.S. Department of the Interior, Bureau of Land Management. 2 vols.

USDI Bureau of Land Management. 1992d. Draft Eugene District resource management plan & EIS. Eugene, OR: U.S. Department of the Interior, Bureau of Land Management. 2 vols.

USDI Bureau of Land Management. 1992e. Draft Klamath Falls District resource management plan & EIS. Klamath Falls, OR: U.S. Department of the Interior, Bureau of Land Management. 2 vols.

USDI Bureau of Land Management. 1992f. Draft Medford District resource management plan & EIS. Medford, OR: U.S. Department of the Interior, Bureau of Land Management. 2 vols.

USDI Bureau of Land Management. 1992g. Draft Roseburg District resource management plan & EIS. Roseburg, OR: U.S. Department of the Interior, Bureau of Land Management. 2 vols.

USDI Bureau of Land Management. 1992h. Draft Salem District resource management plan & EIS. Salem, OR: U.S. Department of the Interior, Bureau of Land Management. 2 vols.

von Sacken, A. 1993. Letter dated 7 June to Ken Denton. 200-20/SOWL: Summary of British Columbia situation regarding spotted owls. 3 p.

Washington Department of Natural Resources. 1992. Letter dated December 22 from Art Stearns. Interim policy and procedures for northern spotted owl class IV special applications. 5 p.

White House, Office of the Press Secretary. 1993b. May 7 Media Advisory: Mission Statement for Forest Conference Working Groups. Includes May 7 memo from Forest Conference Executive Committee to Forest Conference Inter-Agency Working Groups re: Statement of Mission, list of working group members, and talking points and questions. 12 p.

# Appendix A

## Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

### Report of the Forest Ecosystem Management Assessment Team

# Appendix A

## Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

This appendix consists of the report titled *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment*. It was prepared by the Forest Ecosystem Management Assessment Team and was presented to the Office of Environmental Policy at the White House on July 1, 1993. It is frequently referred to in this Draft SEIS as "the FEMAT Report."

Organization of the FEMAT Report

*Forest Ecosystem Management: An Ecological, Economic, and Social Assessment* consists of ten chapters:

I. Executive Summary
II. Overview and Summary of Options and their Evaluation
III. Option Development and Description
IV. Terrestrial Forest Ecosystem Assessment
V. Aquatic Ecosystem Assessment
VI. Economic Evaluation of Options
VII. Social Assessment of Options
VIII. Implementation and Adaptive Management
IX. Glossary

The report also contains a list of the scientists and analysts who prepared the report, and a bibliography.

The report is bound separately from the Draft SEIS. It was included with copies of the Draft SEIS sent to agencies, libraries, and those readers who requested it. It is readily available upon request.

To request a copy of *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment* send a request in writing to:

FEMAT Report Request
Interagency SEIS Team
P. O. Box 3623
Portland, OR 97208-3623

Please mail your request for the FEMAT Report in a separate envelope from any other comments, requests, or correspondence. Send comments on the Draft SEIS to the address on the title page of this document.

# Appendix B

## Additional Information on Standards and Guidelines

# Appendix B
# Additional Information on Standards and Guidelines

This appendix contains additional information about specific standards and guidelines or processes, as referenced in Chapter 2, The Alternatives.

## TABLE OF CONTENTS

1. **Revised Preferred Alternative -** Description of the Bureau of Land Management's Revised Preferred Alternative, which was developed following receipt of public comments to the August 1992 Draft Resource Management Plans.

2. **Principles for Management -** (a) Ecological Principles for Management of Late-Successional Forests: The Basis for Standards and Guidelines, and (b) Development and Description of Terrestrial Options.

3. **Adaptive Management Areas -** From the FEMAT Report.

4. **Protection Buffers -** Additional Standards and Guidelines for Other Species in the Upland Forest Matrix, from the Scientific Analysis Team Report (Thomas et al. 1993).

5. **Recovery Plan Standards and Guidelines -** Standards and guidelines for management of Federal lands, adapted from the *Final Draft Northern Spotted Owl Recovery Plan* (USDI 1992a).

6. **Aquatic Conservation Strategy** - Excerpts from Chapter V of the FEMAT Report specific to delineation and management of riparian reserves, key watersheds, watershed analysis, and watershed restoration.

7. **Grants Pass Line -** Line between northern and southern General Forest Management Areas, from the map of the Preferred Alternative, Draft Medford District Resource Management Plan and Environmental Impact Statement, August 1992 (USDI 1992f).

# Appendix B

## 1. REVISED PREFERRED ALTERNATIVE - DESCRIPTION OF THE BUREAU OF LAND MANAGEMENT'S REVISED PREFERRED ALTERNATIVE WHICH WAS DEVELOPED FOLLOWING RECEIPT OF PUBLIC COMMENTS TO THE AUGUST 1992 DRAFT RESOURCE MANAGEMENT PLANS.

### Preface

In August 1992, the Salem, Eugene, Coos Bay, Roseburg and Medford Districts and the Klamath Falls Resource Area of the Lakeview District of the BLM published Draft Resource Management Plans and Environmental Impact Statements. The following is part of an unpublished draft document that summarizes the BLM revision intended for the Draft RMP/EISs for western Oregon. The entire document was provided to the Forest Ecosystem Management Assessment Team for use in developing various options for the FEMAT Report (Appendix A). The sections that are not reproduced in this appendix are those portions that have little bearing on the development of an overall strategy for managing old-growth forests.

Following the analysis of public comments on the Draft Plans, resource specialists and managers revised the strategy set forth in the preferred alternative in the Drafts. This revision was intended to be developed into the Proposed Resource Management Plans and Final Environmental Impact Statements for the western Oregon BLM Districts. This was originally expected to be published during the summer of 1993. Work was stopped on this project as a result of President Clinton's directive to develop an interagency approach that would consider forest management within the range of the northern spotted owl. The reader should note that this portion of Appendix B reflects the developmental stage of the Revised Preferred Alternative at the time work was interrupted. The editing and revision that was anticipated did not take place. However, the text and accompanying maps show the management direction and land use allocations that were used by the Assessment Team and which are part of the various alternatives described in this SEIS.

Important revisions to the Draft Plans include:

- The change of connectivity design from a corridor concept to an island biogeography concept that uses islands of habitat to link large habitat areas, and to add richness and diversity to the General Forest Management Area (the matrix). These habitat islands, usually 600 acres or larger, are referred to as Connectivity - Diversity Blocks.
- The addition of *managed pair areas and reserved pair areas* as described in the *Final Draft of the Northern Spotted Owl Recovery Plan* (USDI 1992a).
- The adjustment of Old-Growth Emphasis Area (OGEA) boundaries to coincide with boundaries of Designated Conservation Areas (DCA) in the Final Draft Northern Spotted Owl Recovery Plan.

District maps show land allocations and are included at the end if this section. The redesigned connectivity is shown along with combined categories of reserve or conservation areas. For a clear and full view of the land allocations and management guidelines these maps should be used in conjunction with the original maps and text published with the Draft RMP/EISs for western Oregon and the standards and guidelines contained in the *Final Draft of the Northern Spotted Owl Recovery Plan* (see Appendix B, Recovery Plan Standard and Guidelines). The relationship of the strategy used in the BLM Draft Plans to the alternatives in this SEIS is described in Chapter 2 of this document.

# BUREAU OF LAND MANAGEMENT WESTERN OREGON RESOURCE MANAGEMENT PLAN

## Introduction

### VISION

The Bureau of Land Management (BLM) will manage the natural resources under its jurisdiction in western Oregon in a manner complimentary to and in cooperation with other land owners, so that both the ecological condition of the natural environment and the social well-being will be maintained and enhanced.

The basic principles supporting this vision are that:

-it is possible and to manage resources in a manner that harmoniously provides for human use and a healthy natural environment;

-stewardship, the intelligent involvement of people working with natural processes, will be essential for successful implementation;

-BLM cannot achieve the vision alone but can, by its management processes and through cooperation with others, be a significant catalyst for achievement;

-the focus must be ecological rather than on a single resource or species;

-a carefully designed program of monitoring, research and adaptation will be the change mechanism for this long term mission.

## Strategy

## Strategy - Western Oregon and District wide.

Lands administered by the BLM can be managed to maintain healthy, functioning ecosystems while providing a sustainable production of natural resources. This management strategy (Ecosystem Based Management) is the careful and skillful use of ecological, economic, social, and managerial principles which ensure the sustained desired conditions of the whole. Ecosystem management is a strategy that emphasizes the whole, and the relationships within the ecosystem; instead of individual independent components. Ecosystem management looks at sustainable systems and products that people want and need. It is a balance between social acceptability, economic feasibility, and physical/biological possibility.

The building blocks for this strategy consist of four major land use allocations, which are designed to meet the overall vision of ecosystem based management of BLM-administered lands in western Oregon. These building blocks are arranged on the landscape to compliment assumed management strategies of other landowners, while restoring or maintaining the diversity, abundance, and distribution of both plant communities and wildlife habitat to prevent species loss.

Objectives for the four major land use allocations are described below:

**Old Growth Emphasis Areas** would be managed to maintain, increase, or develop old growth character. They would be located where they would support regional biological diversity and would represent approximately 25 percent to 30 percent of BLM administered lands in western Oregon.

**General Forest Management Areas** would be managed for forest production while providing for long term site productivity, forest health, cavity nester habitat, and biological legacies. A variety of seral stages would be represented. In the next few decades older forest seral stages would be retained but in the long term, the landscape in the GFMA would have a mosaic of even-aged stands (except southern GFMA and Klamath Falls) ranging from young stands to stands 70 to 110 years old.

**Connectivity/Diversity Blocks** would be managed to provide movement, dispersal, connectivity opportunities and add to the richness and diversity of the landscape. Approximately 25-30 percent of these blocks would be retained in old growth condition. Where old growth was not available, 25-30 percent of the oldest available forest would be retained. These areas would be located within the GFMA to complement larger old growth areas such as OGEAs, wildernesses, and parks.

**Special Management Areas** would be managed to maintain the special values they represent such as riparian, research natural areas, recreation, or environmental education. They contribute to the overall strategy by providing a diversity of habitats throughout the landscape. Special Management Areas are scattered throughout the landscape and often overlap the other three land use allocations. These areas contribute to the overall strategy by providing a diversity of habitats throughout the landscape.

The specific objectives for these special management areas are identified in the following Resource by Resource discussion.

## Implementation

The RMP establishes objectives and land use allocations at a relatively broad level. Under ecosystem based management, implementation is best accomplished at the landscape level. Landscape level management considers all resources and social and economic values at the same time when designing actions; looks at an entire landscape (watershed, subwatershed or other logical ecological landscape); considers all lands in landscape (ignore property lines); builds partnerships to facilitate and enhance landscape/ecosystem management; and where appropriate, consolidates and replaces individual resource specific activity plans with landscape level plans. These plans will be developed considering all components of the ecosystem, rather than the prior method of concentrating on one resource, such as a recreation area that only discussed recreation opportunities and not wildlife habitat projects.

A landscape is a heterogeneous area composed of a cluster of interacting ecosystems that are repeated in similar form throughout. For example, an area drained by major stream, within a climatic regime, geomorphic processes, and natural vegetation patterns are fairly uniform. A landscape is larger than a stand and smaller than a region, and thus can vary greatly in size.

A key feature of landscape management is considering the landscape in relationship with the next larger and next smaller landscape. For example, when planning for a landscape consisting of a 6,000 acre subwatershed, one would also consider its relationship to the entire watershed as well as looking at how seral stages, stands, or plant communities are distributed within the subwatershed and next larger landscape. Regardless of the scale, the relationship of each resource with all other components of the ecosystem must be weighed. Social aspects were also regarded as an important aspect of prescribing management actions, and will continue to be important while implementing the plan.

In order to implement landscape level activities most efficiently, information on particular components (such as rare species and animals with a range of occurrence in more than one landscape unit) will be collected across the larger ecosystem. Ecosystem level strategies providing the "big picture" of the resource will need to be developed to provide flexibility and broad-based management of these components over the long term in the various landscape units where they occur across the ecosystem.

Actions proposed where landscape plans are not complete would consider landscape issues in order not to preclude options for landscape management. For example, the design of a timber sale would look beyond the stands proposed for harvest and consider its impact on the spatial patterns, seral diversity, etc. of the subwatershed or watershed that may be the landscape they are in. Ecosystem based management implies looking at our actions in terms of the various ecosystem scales, most importantly to consider the next larger scale in the landscape, looking at all the interacting pieces, not just one specific resource.

## Adaptive Management

The management actions/direction are intended to be adaptive in nature and subject to changes from monitoring and/or research. An intensive monitoring program closely linked to established resource objectives and thresholds or a range of thresholds is a critical part of implementation. Monitoring results may lead to amendments of the PRMP or modifications to specific management directions. Adaptive management is critical to assuring the success of an ecosystem based management approach reflecting the complexity and variation found "out on the ground".

Adaptive management could entail modification of silvicultural prescriptions to respond to increasing knowledge providing greater certainty about anticipated climate change, or to respond to increasing knowledge about the habitat needs of northern spotted owls, to cite two examples that could have widespread application. It could equally entail modification of rather localized management practices to respond to the results of monitoring.

Another example of adaptive management would include changing or updating inventory information to reflect new information. For example, revisions or refinements to the Timber Production Capability Classification (TPCC) are ongoing. If these changes became significant, corresponding adjustments would be made in RMP decisions and/or outputs (expected ASQ).

## Resource by Resource Discussion

The following discusses Objectives, Land Use Allocations, and Management Actions/Direction for the various resources, commodities, and programs. Although described separately, each contribute collectively and cumulatively to meeting the overall strategy of managing the bioregion and must be considered together to accurately reflect the concept of ecosystem based management.

In this document, an **objective** is the desired condition of a resource that the BLM will work toward using prescribed management actions and land use allocations. **Land Use Allocations** are the uses for an area that are allowed, limited, or excluded, as well as the terms and conditions of these uses. **Management actions/direction** are those specific actions that the BLM intends to take in order to achieve the objectives described for each resource or program. It is anticipated that as we implement the plan we may adapt these management actions/direction to assure that we meet the objectives.

# BIOLOGICAL DIVERSITY

## Resource Condition Objectives

Restore or maintain the diversity of naturally occurring ecosystems, communities and native species in abundances and distributions which prevent the loss of native plant community types or indigenous plant or wildlife species habitat within the District.

Maintain representative examples of the full spectrum of ecosystems, biological communities, habitats and their ecological processes. Provide for the increase of the scientific understanding of biological diversity and conservation.

Protect, enhance and restore the plant community structure, species composition and ecological processes of special habitats to sustain healthy function.

Restore or maintain or old growth forest areas to provide for those plant and animal species and processes associated with these habitats.

Establish a system of old growth habitat islands (connectivity/diversity blocks) across the General Forest Management Area (GFMA) to provide for movement, dispersal, and connectivity of plant and animal species, and to maintain ecotypic richness and diversity in the forest matrix of the GFMA. These **connectivity/diversity blocks** would be arranged on the landscape in size and number to provide for the following:

- wide ranging animals can travel, migrate, meet mates
- genetic interchange can occur
- populations can move in response to environmental change and natural disasters.
- individuals can recolonize habitats from which populations have been locally extirpated.
- link physiographic regions, large habitat areas (ecological continents) i.e. OGEAs, wilderness areas, USFS, DCAs, etc.
- add or maintain richness and ecotypic diversity to the landscape
- allow for unknown species and processes (keep the pieces strategy).

Within the GFMA emphasis would be placed on use of intensive forest management practices and investments to maintain a high level of sustainable timber production while maintaining long-term site productivity, biological legacies, and a biologically diverse forest matrix.

## Land Use Allocations

Manage **old growth emphasis areas (OGEAs)** for old growth forest conditions. These are located where they support regional biological diversity. These areas would also be managed to provide large blocks of habitat for spotted owls and are coincident with the Designated Conservation Areas (DCAs) in the Draft Recovery Plan for the Northern Spotted Owl.

**Connectivity/diversity blocks** would be established, usually about 640 acres in size, using a landscape strategy which incorporates the following considerations:

- value of the old growth habitat island is related to the matrix or context within which it occurs; eg., agricultural, industrial forest, residential, etc.
- structure or content of the island; eg., forestable acres, existing age classes or condition, etc.
- complement the landscape pattern, make use of, strengthen, tie-in landscape features such as special

areas, VRM, special status species habitat, wild and scenic rivers, riparian management areas, TPCC, watershed, etc.
- areas that either presently lack or would lack under GFMA management landscape ecotypic diversity and richness
- strategic location for function and integrity; eg., connectivity of OGEAs, DCAs, physiographic regions, etc.
- opportunity for travel corridors and connectivity eg. riparian, VRM, TPCC, etc.

The strategy for establishing the **connectivity/diversity blocks** would incorporate the concepts of island biography. The number of islands would be an important consideration and the balanced against size. The large habitat islands or continents would be set in the OGEAs, RPAs, MPAs, DCAs, wilderness areas and other large reserves on BLM and USFS land. The biological diversity blocks would create habitat archipelagos and connect the large habitat islands. The biological diversity blocks would complement the large islands by creating a greater number of habitat islands with smaller inter-island distances which would provide greater connectivity and greatly increase the prospect for frequent colonization, movement, etc. The potential flora and fauna interaction between habitat areas would be increased.

The number of biological diversity blocks needed to create or maintain landscape richness and diversity would vary depending on the specific context or matrix of an area.

**General Forest Management Areas** would be managed for forest production while providing for long term site productivity, forest health, cavity nester habitat, and biological legacies. A variety of seral stages would be represented. In the next few decades older forest seral stages would be retained but in the long term, the landscape in the GFMA would have a mosaic of even-aged stands (except southern GFMA and Klamath Falls) ranging from young stands to stands 70 to 110 years old.

**Special Management Areas** would be managed to maintain the special values they represent such as riparian, ACEC, research natural areas, recreation, marbled murrelet sites, fragile sites, or problem reforestation sites. They contribute to the overall strategy by providing a diversity of habitats throughout the landscape. Special Management Areas are scattered throughout the landscape and often overlap the other three land use allocations. These areas contribute to the overall strategy by providing a diversity of habitats throughout the landscape.

**Special habitats** (forested or non-forested) which are distinct from the general forest matrix such as ponds, bogs, springs, seeps, marshes, swamps, prairies, meadows, oak woodlands, dunes, balds, cliffs, caves, talus slopes, rock outcrops, serpentine barrens, bluffs, caves, salt licks, and mineral springs would be maintained in a natural condition in the same abundance and distribution across the landscape. Protect and maintain species composition, ecotones and ecological processes of these habitats to sustain a healthy ecosystem and contribute to maintenance of biological diversity. Special habitats occur across all land use allocations.

## Management Actions/Direction

## Old Growth Emphasis Areas

Existing old growth forests and spotted owl habitat would be maintained. Stands would be managed to accelerate the development of old growth forest conditions and spotted owl habitat.

**Management actions/direction** are those specific actions that the BLM intends to take in order to achieve the objectives described for each resource or program. It is anticipated that as we implement the plan we may adapt these management actions/direction to assure that we meet the objectives.

Management activities would include young stand maintenance and management and density management thinning to speed up or enhance old growth habitat. Density management harvests would be limited to 10 percent of any OGEA per decade. Regeneration harvest would be deferred for 80 years. After 80 years, regeneration harvesting would be limited to systems designed to reestablish ecological old growth conditions or to maintain those conditions.

Prescribed fire and density management would be used where appropriate to maintain or restore ecological processes and forest health, or prevent appreciable loss of habitat. In some cases there are significant threats to habitat maintenance posed by forest health factors, such as unnaturally dense stands or understories resulting from fire suppression. In these situations, departures from the established management direction could be allowed from the established management direction in order to preclude the loss of spotted owl habitat or old growth forest stands. Proposals for such departures would be contingent upon concurrence by the Interagency Spotted Owl Conservation Group (INSOCG).

Management activities would maintain or improve the present function of spotted owl habitat (eg. nesting roosting, foraging, or dispersal). In addition, activities would not retard the development of suitable habitat or old growth characteristics. In addition, no activities would be allowed within 1/4 mile of active spotted owl nesting centers of activity and no density management would occur within 1/4 mile.

Activity plans would be developed for the OGEAs to direct site-specific management activities. These plans would include an assessment of wildfire potential, role of prescribed fire, and road management. Unless these plans direct otherwise, intensive fire suppression strategies would be used when controlling wildfire and new road construction would be minimized to that necessary for thinning. Only arterial and major collector roads would remain open to the public in these areas.

## Connectivity/Diversity Blocks

The connectivity/diversity blocks would be managed to maintain a minimum of 25% to 30% old growth condition both long term and short term where it exists. The percentage of old growth habitat may be measured at a sub watershed or compartment level that consists of logical groups of connectivity diversity blocks. The percentage of habitat could include existing SMAs. The size and arrangement of habitat within the block should provide as effective habitat as possible.

The silvicultural retention system used would be designed to recreate forest ecosystems that closely resemble natural old growth systems in composition, structure, and function. Retained structural components would include live trees, snag, and large down woody material. These would be distributed in various ways in the stand on the landscape. Hardwoods would be retained or restored in stands at a level consistent with the identified target stand. The silviculture retention system would mimic a moderately heavy large scale natural disturbance event which results in the initiation of a new stand cohort. The regeneration harvest would resemble a shelterwood cut with trees scattered irregularly and/or grouped. Retained trees would represent a range of species, vigor and condition.

The connectivity/diversity blocks would be managed with 12 to 18 green conifers retained per acre at regeneration harvest. The silvicultural goal of the retention trees and subsequent density management would be the recovery of old growth conditions in approximately 100 to 120 years. Following wildfires or other large disturbances, salvage logging would be allowed, leaving at least 4 snags per acre, all remaining green trees and at least 4 tons of coarse woody debris. Stands under 150 years old, and smaller, more fragmented stands, would have a higher priority for harvest than older, more intact stands.

## General Forest Management Areas

Emphasis would be placed on the use of intensive forest management practices and investments to maintain a high level of sustainable timber production while maintaining long-term site productivity, biological legacies, and a biologically diverse forest matrix.

Regeneration harvest units would retain a minimum of 6-8 green conifers per acre, along with snags, coarse woody debris, and hardwoods to provide a biologically diverse stand.

**Retain Port Orford Cedar** to identify genetically transmitted resistance mechanisms and for its contribution to biological diversity. Proactively manage to limit the spread of Phytophthora Lateralis and reduce the number of infected areas.

Manage **Pacific yew** consistent with U.S. Forest Service/BLM strategy. This strategy includes assuring a sustainable supply of taxol while maintaining the presence and function of Pacific yew in the ecosystem.

## Special Habitats

Generally a 100-200 foot buffer would be maintained but this could be increased, decreased or manipulated based on site specific circumstances and the objective to protect the special habitat values. Ecologically significant buffers would be determined by interdisciplinary teams comprised of all program specialists.

Use silvicultural prescriptions and fire management to manage special habitats such as oak woodlands, prairies, meadows, marshes and grassy balds to prevent the encroachment of dense underbrush, shade-tolerant conifers and other species not naturally found in these plant communities under more natural fire conditions.

New roads and other rights-of-way (pipelines, powerlines, etc.) would avoid special habitats which contain components or are themselves not represented adequately within the landscape to maintain biological diversity. Where new roads or other rights-of-way affect special habitats, they would be located to minimize effects to these habitats where physically possible.

# WATER, SOIL, RIPARIAN, AND WETLAND RESOURCES

## Objectives

Manage water resources in compliance with legal requirements to protect, maintain, or improve the quality of water resources and watershed values associated with BLM-administered land, including surface and ground water quality and quantity.

Meet or exceed State water quality standards and protect designated beneficial uses.

Maintain or improve the biological, chemical, and physical functions of the stream ecosystem.
Manage riparian zones to maintain or improve riparian conditions that support water-related functions (e.g. streambank stability, physical filtering of water, source of coarse woody debris to dissipate flood energy and create aquatic habitat, water storage, aquifer recharge, carrying and storing flood flows, and insulating streams from summer and winter temperature extremes).

Manage riparian zones and wetlands in accordance with the BLM Riparian-Wetlands Initiative for the 1990s. Management would emphasize: protection of riparian-wetland areas and associated uplands; rehabilitation and maintenance of riparian-wetland areas; and partnership and cooperative rehabilitation and management of riparian-wetland areas.

Maintain or improve riparian habitat for wildlife and native plant diversity.

Protect wetlands in accordance with Executive Order 11990 to minimize destruction, modification, loss or degradation and to preserve and enhance their beneficial values.

Protect floodplains in accordance with Executive Order 11988 to restore and preserve their natural and beneficial values.
Manage watersheds providing surface water used by community water systems to comply with the Clean Water Act.

Manage uplands to minimize nonpoint source pollution and moderate extremes in streamflow by maintaining or improving hydrologic functions (e.g. infiltration, instream flow, ground water quantity, etc.).

Protect long-term soil productivity by minimizing erosion, including landslides, and maintaining beneficial physical and chemical properties of soils.

## Stream/RMA Condition Objectives by Stream Order and Type

The following stream condition objectives apply specifically to the GFMA and Connectivity/Diversity Blocks. Higher levels of protection will be provided in OGEAs and Special Management Areas.

**Non-Fish-Bearing; Intermittent; Order 1**

Stable stream channel and banks.
Adequate vegetation to minimize entry of nonpoint source pollution (e.g. sediment) from upslope activities into stream channel.
Adequate stream structure to minimize sediment movement downstream.
Adequate shade to prevent evaporation of subsurface moisture in stream channel.
50 percent of natural large woody debris input.
Low to Moderate level of aquatic habitat.
Marginal habitat conditions along hardwood and shrub buffers for terrestrial amphibians and small mammals.

**Non-Fish-Bearing; Intermittent; Order 2**

Stable stream channel and banks.
Adequate vegetation to minimize or prevent entry of nonpoint source pollution (e.g. sediment) from upslope activities into stream channel.
Adequate stream structure to minimize sediment movement downstream.
Adequate shade to prevent evaporation of subsurface moisture in stream channel.
70 percent of optimum large woody debris input.
Moderate level of aquatic habitat.
Marginal habitat conditions along hardwood and shrub buffers for terrestrial amphibians and small mammals.

### Non-Fish-Bearing; Perennial; Order 1 and 2

Stable stream channel and banks.
Adequate vegetation to prevent entry of nonpoint source pollution (e.g. sediment) from upslope activities into stream channel.
Adequate stream structure to minimize sediment movement downstream.
95-100 percent of optimum stream shading to maintain or reduce summer maximum water temperatures.
80 percent of optimum large woody debris input.
Moderate level of aquatic habitat.
Limited amounts of suitable habitat for terrestrial amphibians and small mammals.
Low level of large mammal travel zones.

### Non-Fish-Bearing; Intermittent or Perennial; Order 3

Stable stream channel and banks.
Adequate vegetation to prevent entry of nonpoint source pollution (e.g. sediment) from upslope activities into stream channel.
Adequate stream structure to minimize sediment movement downstream.
95-100 percent of optimum stream shading to maintain or reduce summer maximum water temperatures.
90 percent of optimum large woody debris input.
High level of aquatic habitat.
Limited amounts of suitable habitat for terrestrial amphibians and small mammals.
Low level of large mammal travel zones.

### Fish-Bearing; Intermittent or Perennial; Order 1, 2, and 3

Stable stream channel and banks.
Adequate vegetation to prevent entry of nonpoint source pollution (e.g. sediment) from upslope activities into stream channel.
Adequate stream structure to minimize sediment movement downstream.
95-100 percent of optimum stream shading to maintain or reduce summer maximum water temperatures.
100 percent of optimum large woody debris input.
High level of aquatic habitat.
High level of fish habitat.
Limited amounts of suitable habitat for terrestrial amphibians and small mammals.
High level of large mammal travel zones.
High level of nesting for riparian associated water birds and raptors.

### Fish or Non-Fish-Bearing; Intermittent or Perennial; Order 4+

Stable stream channel and banks.
Adequate vegetation to prevent entry of nonpoint source pollution (e.g. sediment) from upslope activities into stream channel.
Adequate stream structure to minimize sediment movement downstream.
95-100 percent of optimum stream shading to maintain or reduce summer maximum water temperatures.
100 percent of optimum large woody debris input.
High level of aquatic habitat.
High level of fish habitat.
Adequate amounts of suitable habitat for terrestrial amphibians and small mammals.
High level of large mammal travel zones.
High level of nesting for riparian associated water birds and raptors.

Table B-1 describes aquatic habitat quality rating:

## TABLE B-1. AQUATIC HABITAT QUALITY RATING SCALE

| Parameter | Level of Habitat Quality | | |
|---|---|---|---|
| | Low | Moderate | High |
| LWD Recruitment | 50% | 90% | 100% |
| Temperature | OR State Stnds | OR State Stnds | OR State Stnds |
| Bank Stability | <50% unstable | <30% unstable | <20% unstable |
| Channel Width: Pool Numbers Ratio | >10:1 | 7-10:1 | 2-6:1 |
| Width: Depth Ratio | 13-14:1 | 11-12:1 | 10:1 |

# LAND USE ALLOCATIONS

## Riparian Management Areas (RMAs)

Riparian Management Areas (RMAs) will be established on all streams, lakes, and ponds to meet water and riparian objectives. RMA widths will be prescribed to fit on-the-ground stream characteristics. Design of RMA prescriptions will consider overall watershed and riparian condition, occurrence of sensitive species, and designation of a water quality limited stream. Specific elements to be considered when determining RMA widths and prescriptions would include:

-Amount of roads in watershed.
-Age and condition of forest stands in watershed.
-Amount of watershed withdrawn from disturbance.
-Topography of watershed and immediate area (i.e. side slope).
-Current condition of aquatic and riparian habitat in watershed.
-Distance to fish habitat if affected stream does not support fish.
-Class of stream (i.e. fish bearing, non-fish bearing, water quality).
-Width of flood plain.
-Width of riparian zone.
-Plant community in both riparian and adjacent upland areas.
-Stand characteristics of conifers in both riparian and adjacent upland areas.
-Amount and type of understory vegetation in riparian zone.
-Soil types in both riparian and adjacent upland areas.
-Channel type (i.e. constrained, unconstrained, bed rock controlled, alluvial controlled etc.).
-Stream size and order.
-Stream gradient.
-Windthrow risk.
-Stream channel condition upstream and downstream from project area.

Expected average RMA widths (on each side of stream) are displayed in Table B-2.

## TABLE B-2. EXPECTED RMA WIDTHS BY STREAM ORDER AND TYPE

<table>
<tr><th rowspan="2">Stream Order</th><th colspan="3">Average RMA Width (feet)</th></tr>
<tr><th>Intermittent</th><th>Perennial</th><th>Fish-Bearing</th></tr>
<tr><td>1</td><td>Partial retention of variable width</td><td>75</td><td>150</td></tr>
<tr><td>2</td><td>Partial retention of variable width</td><td>75</td><td>150</td></tr>
<tr><td>3</td><td colspan="2">105</td><td>150</td></tr>
<tr><td>4</td><td colspan="3">150</td></tr>
<tr><td>5</td><td colspan="3">210</td></tr>
<tr><td>6+</td><td colspan="3">240</td></tr>
<tr><td>Lakes and ponds</td><td colspan="3">150</td></tr>
</table>

Minimum RMA widths on each side of fish-bearing streams (generally third order and larger streams) or adjacent to lakes and ponds will be the larger of the following three widths: the riparian zone, the floodplain, or 100-feet horizontal distance from the high water mark. Average RMA widths will be wider and vary by stream order.

## Timber Production Capability Classification

As part of the inventory of lands suitable and capable of being managed for timber production landslide prone soils and other unstable soils were identified as not suitable, in part to protect watersheds. Other surface-disturbing activities will be prohibited unless adequately mitigated to protect water quality.

## Management Actions/Direction

RMAs along all streams, lakes, and ponds will be managed to meet the water and riparian objectives. Within RMAs along fish-bearing, perennial, or third order and larger streams, lakes and ponds, limited management activities could occur to achieve resource management objectives such as stream/riparian enhancement, enhancement of fish and wildlife habitat, yarding corridors to facilitate timber harvest outside the RMA, and road crossings. Prescribed fire and silvicultural activities could be used to meet RMA management objectives. Snags and down logs will be retained as identified in Chapter 2, Wildlife.

For RMAs along first and second order, non-fish-bearing, intermittent streams, management activities such as stream/riparian enhancement, timber harvest, road crossings, prescribed fire, planting, and precommercial thinning could occur if designed to meet the water and riparian objectives. Management of these RMAs will emphasize leaving brush, hardwoods, Pacific yew, an nonmerchantable and noncommercial vegetation to achieve objectives, however, it is expected that some conifer retention will also be necessary to meet objectives.

**Management actions/direction** are those specific actions that the BLM intends to take in order to achieve the objectives described for each resource or program. It is anticipated that as we implement the plan we may adapt these management actions/direction to assure that we meet the objectives.

Protection for wetlands could include buffering, not entering, or other measures as needed based on site-specific conditions.

Springs will be managed as special habitat (see Wildlife section).

Management activities will comply with Oregon's Regulations Relating to Water Quality Control (Oregon Administrative Rules 340-41), including the Antidegradation Policy. The purpose of the Antidegradation Policy, which includes policies on high quality waters, water quality limited waters, and outstanding resource waters, is to protect, maintain, and enhance existing surface water quality to protect all existing beneficial uses.

Management actions will be consistent with Oregon water quality management programs for designated water quality limited streams.

Management activities will be consistent with Oregon's Nonpoint Source Statewide Management Program. A nonpoint source management program will continue to be implemented in cooperation with the U.S. Environmental Protection Agency and the Oregon Department of Environmental Quality (DEQ) to assure protection of water and water-dependent resources. Oregon's nonpoint source management program requires BLM to implement best management practices (BMPs) which protect the beneficial uses of water. BMPs will be selected based on site-specific conditions, technical and economic feasibility, and the water quality regulations for waters potentially affected. Timber harvesting, minerals management, recreation, off-road vehicle (ORV) use, and other surface-disturbing activities will be managed to protect water quality.

Watershed and stream enhancement activities such as reducing soil compaction, vegetating disturbed areas, and stabilizing streambanks will be conducted to achieve water and soil resource objectives.

Chemical uses by BLM, authorized contractors, and mining operators will provide for protection of both surface water and ground water. Examples of chemicals used could include, but are not limited to, herbicides, pesticides, fertilizers, fire retardant, solvents at maintenance shops, and fuels and chemicals used in mining operations. Herbicides will not be applied within 500 feet of any residence or other place of human occupancy without the occupant's consent or within 100 feet of any cropland.

Herbicides will not be applied by helicopter within 100 feet of any surface waters, by ground vehicles with boom sprayers within 25 feet of surface water, or by vehicle-mounted handguns or with backpacks within 10 feet of surface water.

Analysis of cumulative effects will help guide overall project scheduling during the life of the plan.

Land exchanges or acquisitions could be used to block up BLM management within watersheds or to obtain key riparian-wetland areas.

# FISH HABITAT

## Objectives

Maintain or enhance the fisheries potential of fish streams and other waters consistent with BLM's nationwide Fish and Wildlife 2000 plan,

Promote recovery of depressed fish stocks.

See the Water, Soil, Riparian, and Wetland section for condition objectives by stream type. They also apply to fish habitat.

### Land Use Allocations

See Land Use allocations and Management Direction for Water, Soil, Riparian, and Wetland Resources.

### Management Actions/Direction

See Land Use allocations and Management Direction for Water, Soil, Riparian, and Wetland Resources.

A regional plan for coastal Oregon, Washington, and California will be created. This plan will serve to update the BLM's current anadromous fish management plan and will provide much increased emphasis on watershed level planning and analysis. In the interim, to the extent of available funding, implementation of BLM's "A Five-Year Comprehensive Anadromous Fish Habitat Enhancement Plan for Oregon Coastal Rivers, 1985" will continue. Projects would be implemented only when they are compatible with Oregon Department of Fish and Wildlife (ODFW) wild fish management policy. Priority would be given to watersheds supporting "at risk" fish stocks. Rehabilitation efforts could also focus on streams that have been devastated by natural catastrophic events.

To protect investments in fish improvement projects, mineral withdrawal would be pursued for the affected stream reach.

In fish producing streams, screening facilities would be required on intakes when granting rights-of-way or easements for water diversions (pipelines and ditches) across public land. Facility design would meet or exceed ODFW standards.

Except for land tenure zone 3 lands, riparian and fish habitat would be retained unless land exchanges would improve management of fish, wildlife, or riparian habitat elsewhere.

BLM would work with Oregon Department of Fish and Wildlife to determine appropriate streamflows for in-stream water rights (Oregon revised statute 537.336 to 537.348) in order to maintain or enhance aquatic habitat, particularly for special status species.

## SPECIAL STATUS SPECIES HABITAT

Special status species include species which are federal listed, federal proposed, federal candidate, state listed, Bureau-sensitive, and assessment species.

### Objectives

Protect, manage and conserve federal listed and proposed species and their habitats to achieve their recovery in compliance with the Endangered Species Act and Bureau Special Status Species policies.

Manage for the conservation of federal candidate, and Bureau sensitive species and their habitats so as not to contribute to the need to list and to recover the species.

Manage for the conservation of state listed species and their habitats to assist the state in achieving their management objectives.

Maintain or restore plant community structure, species composition, and ecological processes of special status plant and animal habitat.

Protect and manage assessment species where possible so as to not increase their status.
Manage federal listed species to achieve their recovery.

The objectives for special status species apply to all land use allocations (OGEAs, Connectivity - Diversity blocks, GFMAs etc.). Acres of special status species habitat designated on the District will change throughout the life of the plan as inventories are conducted and the status of species change.

Land acquisitions would be pursued where needed to assure survival or recovery of federal listed, proposed, or candidate species.

## Land Use Allocations

See discussion under each species, following.

Many Special Habitats and Special Areas (see also Biological Diversity and Special Areas sections of the RMP) are designated in the RMP for conservation of special status plant or animal habitats.

## Management Actions/Direction

General management actions/direction for special status species habitat is followed by management actions/direction specific to individual species or special habitats.

## General

Management actions pertaining to all special status plant and animal species and their habitats in general is presented immediately below and is followed by management actions which are specific to particular plant and animal species or habitats.

In all land use activities and under all land allocations avoid, protect or mitigate for all special status species populations and habitat so as to not contribute to the need to list the non-federal listed species and to promote recovery of federal listed species. A variety of mitigation measures are possible and vary according to the specific situation.

All proposed actions will be reviewed for special status species and field surveys will be conducted during the proper season when necessary for agency controlled actions. Field surveys may not be conducted in all cases depending on the number and timing of previous surveys conducted in the proposed action area and the amount or likelihood of potential habitat present. The intensity of field surveys will also vary depending on the same factors.

If a proposed action is determined to affect any federal listed, federal proposed, federal candidate, state listed, or Bureau sensitive species or any of their critical or essential habitat, efforts would be made to modify, relocate, or abandon the project to avoid affecting the species or its habitat. When BLM determines that a management action that could adversely affect a federal listed, federal proposed or federal candidate species can not be altered and should not be abandoned, then consultation or technical assistance with the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) will be initiated.

We will coordinate with the USFWS and NMFS in compliance with the Endangered Species Act and jointly endeavor to recover the listed and candidate plant and animal species, their habitats and ecosystems.

We will coordinate and cooperate with the State of Oregon whenever necessary to assist the BLM in achieving conservation of state listed species.

The distribution, abundance, reasons for current status, and habitat needs will be determined for federal candidate and Bureau sensitive species occurring on BLM administered land and the significance of BLM administered land or actions in maintaining those species will be evaluated. For those federal candidate or Bureau sensitive species where BLM administered land or actions have a significant affect on their status, rangewide or site specific management plans will be developed and implemented and will include specific habitat and population habitat objectives designed for recovery.

All habitat essential for the survival of federal and state listed, federal candidate and Bureau sensitive species will be retained in federal ownership. Where appropriate opportunities exist, land acquisitions through exchange, purchase or donation would be pursued where it would contribute to recovery, reduce the need to list by providing protection, block up ownership, or enhance special status species habitat. Specific opportunities and needs would be identified in site-specific management plans.

Consistent with other plan decisions, Bureau assessment species will be protected so as not to increase their status. They will be included in all field inventory and clearance work and all new locations will be documented. Assessment species will be considered in all environmental analyses where impacts, if any, will be clearly identified for the population and the species as a whole. As funding permits and as species conservation dictates, active management for assessment species may be undertaken to assure survival of these species in Oregon. Prior to any vegetative manipulation, surface disturbing activity, or any disposal of BLM administered land, a review of the affected site or areas will be conducted for special status plant and animal species. If a proposed action is determined to affect any federal listed, federal proposed, federal candidate, state listed, or Bureau sensitive species or any critical or essential habitat, efforts would be made to modify, relocate, or abandon the project to avoid adversely affecting the species or its habitat. When BLM determines that a management action that could adversely affect a federal listed, federal proposed or federal candidate species can not be altered and should not be abandoned, then consultation with the U.S. Fish and Wildlife Service will be initiated. Correspondence with the state will be conducted whenever necessary to assist the state in achieving their objectives for state listed species.

### Habitat (plant or wildlife) or Species Specific:

### Northern Spotted Owl (Federal Threatened Species)

#### Objectives

**Promote recovery, protect existing owls....**

#### Management Actions/Direction

**Residual habitat areas** of about 100 acres in size of nesting, roosting, and foraging habitat would be protected around the known activity centers for owl pairs or territorial singles. The intent is to protect the core areas in the short term and to provide potential nest sites in the long term except for those sites that exceed the target number per township identified in the recovery plan. All habitat is reserved for an expected 80 years.

**Reserved Pair Areas** would be protected to supplement DCAs until they become fully functional by maintaining additional suitable habitat and activity centers outside of OGEAs. These reserved pair areas consist of the area surrounding the activity center of a pair or resident single owl at least equal to the median home range size of pairs in the province. All habitat is reserved from harvest for an expected 80 years.

**Managed Pair Areas** managed (and available for harvest) so long as the median amount of suitable habitat in home ranges of observed pairs in the province is maintained. All habitat would be reserved for 10 years.

There would be no tree falling within one-quarter mile of all active northern spotted owl nest sites from approximately March 1 to September 30 to avoid disturbance and harm to young owls.

Human activities which could disturb owl nesting, especially use of large power equipment, would be prohibited within one-quarter mile of all active spotted owl nest sites from approximately March 1 to September 30. Nest located next to roads or other areas of human disturbance would not usually result in restrictions.

### Marbled Murrelet (Proposed Federal Threatened Species)

#### Objectives

**Will be added**

#### Management Actions/Direction

Inventories and monitoring for this species would be instituted.

Any nest locations and occupied habitat areas would be protected. Human disturbance around these sites/ stands would be minimized between approximately March 1 and July 15.

### Bradshaw's lomatium (*Lomatium bradshawii*) (Federal and State Endangered)

*The following is an example.*

#### Objectives

**Will be added.**

#### Management Actions/Direction

A Recovery Plan for Bradshaw's lomatium has not yet been released by the U.S. Fish and Wildlife Service. Interim management of the species will include:

- Identification of Bradshaw's lomatium as a special value in and continue the designation of Long Tom ACEC which is its only present habitat on BLM administered land;
- Prescribed fire for habitat enhancement and maintenance;
- Monitoring of the effects of prescribed fire on control of the invading species and of its affect on the species;
- Studies and monitoring of population dynamics, hydrological and soil characteristics required by the plant in its native prairie habitat;
- Coordination with US Fish and Wildlife Service, The State of Oregon, the US Army Corps of Engineers and The Nature Conservancy in management of the species across the landscape;

- Pursuit of opportunities for education about conservation of Bradshaw's lomatium;
- Pursuit of opportunities to increase the number of populations of Bradshaw's lomatium under BLM management through acquisition and reintroduction.

When the Recovery Plan is issued, BLM will implement management actions identified for BLM. As needed, we will continue to implement interim management actions identified above. If the Recovery Plan and this RMP are not adequate to cover objectives and actions relative to this species, a management plan will be developed.

As we gain new knowledge about the species requirements and threats we will conduct other activities needed to implement the Recovery Plan.

**Bald Eagle (Federal Threatened Species)**

**Objectives**

**Will be added**

**Management Actions/Direction**

All actions would be consistent with the Pacific Bald Eagle Recovery Plan. Known habitat sites and potential sites identified in the Recovery or Implementation Plans would be protected.

**Peregrine Falcon (Federal Endangered Species)**

**Objectives**

**Will be added**

**Management Actions/Direction**

All actions would be consistent with the Peregrine Falcon Recovery Plan. Known habitat sites and potential sites identified in the Recovery or Implementation Plans would be protected.

Within one mile of active peregrine falcon nest sites, human disturbances with the potential to disturb the nest would be minimized and roads (except major arterial roads) would be closed between February 1 and August 15. The areas would be managed to retain diversity of habitats for prey species. They would be designated fire fuels management areas to reduce fuel loadings and manage habitat conditions. As opportunities exist, forage for prey species could be enhanced through plantings of mast and berry producing shrubs. All BLM-administered land would be retained in federal ownership. A HMP would be prepared to provide more specific management guidelines for peregrine falcons.

The core area within one-half mile of active peregrine nest sites would receive additional protection. In addition to the measures used in the one-mile radius within the protected core area, there would be no scheduled timber harvest, no aerial application of herbicides or pesticides, and NSO for leasable minerals. There would be no new road construction unless the activity would not adversely effect the integrity of the site. These areas would be designated priority fire suppression areas.

Potential nest cliffs would be managed to provide for future population expansion. The cliffs themselves would be protected and enhanced if necessary. No new road construction would be permitted within one-half mile of these potential nest sites unless the activity would not adversely affect the integrity of the site, and there would be no surface occupancy for leasable minerals. These potential nest sites would be retained under BLM administration.

## Townsend Big Eared Bat

### Objectives

**Will be added**

### Management Actions/Direction

Dense forest conditions would be retained if present or restored where possible around known colony caves. No new road construction would be permitted and human disturbance would be minimized. Seasonal recreational use of these caves could be permitted if it would not interfere with the bats. No surface occupancy would be allowed for leasable minerals. All BLM-administered land would be retained in federal ownership. Caves and mine adits would be inventoried for bats.

## Siskiyou Salamander and Del Norte Salamander (Federal Candidate Species)

### Objectives

**Will be added**

### Management Actions/Direction

Surface-disturbing activities would be avoided where feasible within 100 feet of talus habitat where the species is found. Habitat (talus areas) where the species is found would be protected in order to provide shady, humid micro-habitat. Potential habitat would be inventoried for these species.

**Special Status Fish** (species will vary by District, Medford example follows)

## Jenny Creek Sucker (Federal Candidate Species), Redband Trout (Federal Candidate Species), Coho Salmon (assessment species, Rogue River basin), Summer Steelhead, (American Fisheries Society, proposed threatened species, Rogue River basin), and Winter Steelhead (American Fisheries Society, proposed threatened species, Illinois River basin)

### Objectives

**Will be added**

### Management Actions/Direction

Timber harvest and other surface-disturbing activities would be prohibited within steep canyon areas along Jenny Creek and tributaries.

Surface-disturbing activities would be designed so they do not degrade habitat for the species listed above.

## WILDLIFE HABITAT (will vary by district, Medford example follows)

The overall objective for managing wildlife habitat is to maintain healthy wildlife populations to contribute to biological diversity and ecosystem health.

**Cavity dwellers and other snag associated species:**

**Objectives**

**Will be added**

**Management Actions/Direction**

**In the General Forest Management Area the following would apply:**

Snags, live cull trees, and green merchantable trees would be retained to provide an average of approximately 60 percent of the optimum primary excavator population habitat needs. This generally corresponds to 180 snags greater than 16 inches dbh per 100 acres of forested habitat.

All unmerchantable snags and culls would be retained unless they pose a safety hazard.

**Within OGEAs, the following would apply:**

Snags, live cull trees, and green merchantable trees would be retained to provide at a minimum the mean number of snags found in each seral stage of unentered stands, plus one standard deviation. This generally corresponds to 350 snags greater than 16 inches dbh per 100 acres of forested habitat.

Coarse woody debris would be retained to provide an average of approximately 60 percent of the mean amounts of down logs found in each seral stage of unentered stands. This generally corresponds to approximately 1,400 tons per 100 acres, with at least 1,300 pieces greater than 16 inches diameter and 12 feet long.

**Raptors, Owls, and Great Blue Herons**

**Objectives**

**Will be added**

**Management Actions/Direction**

Nest sites, centers of activity, or rookeries would be protected as necessary to maintain the integrity of the site. Human disturbances which may disturb or interfere with nesting would be prohibited within one-quarter mile of active nesting areas between approximately March 1 and July 15.

Nesting platforms, nest boxes, and other structures would be erected to enhance habitat for osprey, other raptors, waterfowl, and other species as opportunities become available.

## Roosevelt Elk

### Objectives

Elk management areas would be managed to enhance elk habitat consistent with the other allocations (timber, old growth, connectivity) for these lands as identified below.

### Management Actions/Direction

Habitat management plans would be developed.

All roads except major collectors and arterial would be closed. New road construction would be minimized.

Roads would be managed through use of gates and other types of road barricades to limit motorized vehicle use to an open road density of 1.5 miles per square mile, where possible.

Seasonal restrictions on activities could be imposed if needed to avoid disturbance and harassment.

Forage habitat would be maintained or enhanced where appropriate by creating small openings in conifer stands of all ages, broadcast burning, seeding, fertilizing, underburning forest stands, or other means.

The mix of forage areas, thermal cover, hiding cover, and optimal cover would be managed to maintain or attain highly viable habitat condition for each of the four indices using the Wisdom Elk Model or equivalent model.

## Deer and Elk Winter Range

### Objectives

Deer and elk winter range in the Cascade foothills would be managed as winter range with an emphasis on providing thermal cover and minimizing disturbances .

### Management Actions/Direction

HMPs or coordinated resource management plans (CRMPs) would be developed for the big game management areas.

All roads, except major collectors and arterial, would be closed between November 15 and April 1. New road construction would be minimized.

At least 20 percent of these areas would be maintained in thermal cover, 70 percent canopy closure, canopy height of at least 40 feet, and large enough to avoid edge effects. Management activities would be allowed in these areas consistent with the objectives for maintaining thermal cover and minimizing disturbance.

Seasonal restrictions would be applied to activities to avoid disturbance between approximately November 15 and April 1.

Where elk management areas overlap with winter range areas, management directions for both areas would be applied.

### Golden Eagles

#### Objectives

#### Management Actions/Direction

Approximately 30 acres would be protected around all known golden eagle nest sites. Within those areas there would be no timber harvest or other habitat removal. Human disturbance would be prohibited between approximately March 1 and July 15. No new roads would be constructed within the 30-acre core area around active nests.

## TIMBER PRODUCTS

### Objectives

Timber management activities would be planned and designed to produce a sustained flow of forest products in order to contribute to long term stability for dependent communities and local industries. A diversity of forest products (timber and non-timber) would be offered in order to support both large and small commercial operations as well as noncommercial operations.

All silvicultural systems would be sustainable, economically practical, and capable of maintaining the long-term health and productivity of the forest ecosystem.

Forest management practices would be designed to retain long-term site productivity, promote ecosystem health, and assure the sustainability of timber production.

Silvicultural treatments and harvest schedules would be designed to assure that wood quality is suitable for the range of current and forecast uses and that maintenance or enhancement of log value is an objective of silvicultural treatments.

### Land Use Allocations

Suitable commercial forestland that would be available for timber management includes land in both the General Forest Management Areas, and Connectivity/Diversity Blocks. In addition, suitable commercial forestland in OGEAs would be available for density management in the next decade and would be available for regeneration harvests pending deferral for eight decades.

**Economically Marginal Lands:** Lands determined to be economically marginal are not included in the timber allocation. Timber harvest could occur from those lands when changed economic conditions made them economical and where consistent with land use allocations.

**Woodlands:** Timber harvest from woodlands is not planned (or included in ASQ estimates) but could occur to carry out management actions designed to achieve nontimber resource objectives as part of research or to salvage mortality. Any harvest would be consistent with other land use allocations and objectives.

**Site Class V Lands:** Site Class V lands would be managed at a lower level of intensity because of economic considerations and uncertainty about the effect of intensive management on poor sites.

**Hardwood Stands: (Medford example)** Hardwood stands would be managed for production of commodities as markets became available, but regeneration with the same hardwood species mix would follow harvest. Up to 1/200th of the total hardwood allocation area could be harvested per year.

**White oak woodlands** would be managed to meet wildlife, range, and biological diversity objectives.

**Enhancement of Other Resources**: Lands unavailable for planned forest management include: woodlands, recreation sites, RMAs, ACECs, wild rivers corridors, and habitat for threatened and endangered and special status species including the northern spotted owl. Timber harvest would occur only as part of strategies to enhance other resources such as riparian habitat, wildlife habitat, or management of special areas. Harvest from these lands, would generally not be included in the planned ASQ.

The following lists some of the reasons that timber harvest could occur on these lands.

Provide more logical logging units or reduce road construction, thereby reducing overall cumulative effects.

Salvage timber killed or substantially damaged by fire, wind throw, insect infestation, or other catastrophe. Such harvest would be accomplished under special silvicultural prescriptions designed to meet the needs of nontimber allocations made on these lands.

Provide for the safety of forest users (including removing hazard trees along roads and trails, in camp grounds and administrative sites, etc.).

Facilitate construction, operation, and maintenance of new facilities such as roads, trails, power lines, communication facilities, recreation or administrative facilities, etc.

Scientific or research studies.

Isolate and release Douglas-fir and sugar pine test trees.

Maintain or enhance fish and wildlife habitats.

Facilitate development of mines, quarries, or fluid mineral leases.

Modify high fuel hazard areas by construction of shaded fuel breaks and/or increase defensible space for fire suppression by maintenance of early seral stage conditions. Such activity could occur to provide protection for timber production areas, old growth blocks, or developed recreational facilities.

### Management Actions/Direction

**Vegetation management** treatments would be based on attainment of allocation objectives including timber production, maintenance of wildlife habitat, and maintenance of species diversity. Herbicides could be utilized in accordance with the anticipated BLM Management of Competing Vegetation Record of Decision, but preference would be given to strategies which redirected natural ecosystem processes where practical and where scientific knowledge was adequate to support such strategies. After a transition period to complete needed stand maintenance on clearcuts created by past management, aerial application of herbicides would decline to a negligible level.

To minimize the **regeneration** period, artificial regeneration would be used to supplement natural reforestation. Planting would occur at minimum needed densities using a mix of native species (generally based on the percentage of species existing in the stand) to help assure species diversity.

Forest **fertilization** would be used with preference given to fertilization of young even-aged stands of site four and higher in the next decade.

Practices that **enhance timber quality,** including pruning, would be used.

**Water quality and site productivity:** Best management practices (BMPs) for soil and water resources would be used in designing site-specific silvicultural prescriptions consistent with the objectives of each plan alternative.

**Salvage of mortality:** Salvage of partial or entire stand mortality would occur where consistent with land use allocations, as well as snag and down wood retention objectives for soils and wildlife (see Wildlife section).

**Species and stocking levels:** The density and species mixture of commercial forest stands would be consistent with the design and theme of each alternative. Both precommercial and commercial thinning would be scheduled to achieve desired levels of timber production, to maintain stand vigor, and to achieve desired stand characteristics.

**Reforestation practices:** All stands subject to regeneration harvest would be promptly reforested using seeding, planting, or natural reforestation techniques. Emphasis would be placed on the use of practices which were based on an understanding of and maintenance of natural ecological relationships.

**Site preparation and stand establishment:** Site preparation, stand maintenance, stand protection, and release practices would be designed to be consistent with ecological site capabilities and would utilize approaches which were ecosystem based. The approaches would utilized biological methods, prescribed burning, chemical treatments, and mechanical or manual treatments to meet plan objectives and be consistent with decisions in the anticipated Management of Competing Vegetation Record of Decision (ROD). Actions would emphasize the use of preventative or ecosystem-based strategies within an integrated approach which considers all available tools, natural ecological processes, human health, economics, fire hazard, environmental quality, and the maintenance of site productivity. Site preparation treatments would occur promptly after yarding to assure timely reforestation.

**Hardwood Conversion to Conifers:** Natural hardwood and shrub communities on suitable commercial forestland would not be converted to conifer production. Stands on commercial forestland which are dominated by commercial conifers, but which also contain a high percentage of hardwoods as a successional stage, would be managed for timber production. Suitable commercial forestland allocated to timber management and dominated by grass, shrubs, and hardwoods which resulted from human activity would be restored to conifer protection. Enough hardwood species would be retained to maintain species diversity.

**Minimum Harvest Age:** The minimum harvest age varies by district, ranging from 60 to 120 years.

**Allowable Sale Quantity (ASQ):** The allowable sale quantity (ASQ) is based on planned timber harvest. Volume sold per year would be as evenly distributed as possible during the decade. Generally, salvage or other unplanned harvest would replace the planned sale volume.

**Utilization standards:** Sale of forest products would be designed to encourage full utilization of harvested timber while reserving structural components (such as snags and coarse woody debris) consistent with objectives for wildlife habitat management, old growth management, biological diversity, and site productivity.

**Logging systems:** Harvesting methods and yarding systems would be selected based on suitability for the successful implementation of silvicultural systems, operational and economic practicality, and protection of site productivity and water quality.

**Roads:** The timber access road network for lands allocated to timber management would be based on attainment of ready access for appropriate logging systems, silvicultural treatments, and fire protection. Road management planning would include access needed for silvicultural treatments, inventory, and other administrative work. Planned road maintenance would protect the existing investment and watershed values.

# SPECIAL FOREST PRODUCTS

### Objectives

Sale of special forest products (firewood, burls, mushrooms, ferns, floral greens, etc.) would be consistent with other land use allocations. Sales would ensure resource sustainability and protection of other resource values such as special status plants or animals species. The market value of such products would be based on their highest and best use.

Develop special forest product programs to support economic diversity of local resource dependent communities.

### Land Use Allocations

Sale of special forest products would be consistent with the objectives for other land use allocations. Areas that would not be available for the sale of special forest products could include:

Areas of Critical Environmental Concern
Research Natural Areas
Outstanding Natural Areas
Special Status fauna and flora sites
Wilderness Areas
Wild river areas
Areas used by Native Americans under existing treaties

### Management Actions/Direction

Species or groups of plants that would be restricted or limited from harvest would vary by district.

# SILVICULTURAL SYSTEMS

The silviculture for the various land use allocations essentially has not been changed for the revised Draft Plans. Although, the Connectivity Areas were redesigned on the landscape level, the silvicultural approach remained the same with the exception of the retention of 25% oldest forest within the Connectivity/Diversity Blocks.

## TABLE B-3 BLM - REVISED DRAFT PREFERRED ALTERNATIVE

(1000s ACRES)

| ALLOCATION CATEGORY | SALEM | | EUGENE | | ROSEBURG | | COOS BAY | | MEDFORD | | W. ORGEON | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONSERVATION AREAS | 201 | 51% | 185 | 59% | 173 | 41% | 131 | 40% | 251 | 27% | 942 | 40% |
| SPECIAL MANAGEMENT | 49 | 12% | 23 | 7% | 55 | 13% | 47 | 14% | 272 | 30% | 445 | 19% |
| CONNECTIVITY | 41 | 10% | 16 | 5% | 54 | 13% | 20 | 6% | 17 | 2% | 149 | 6% |
| GEN. FOREST. MGT. | 107 | 27% | 91 | 29% | 137 | 33% | 129 | 39% | 379 | 41% | 843 | 35% |
| TOTAL | 398 | 100% | 315 | 100% | 419 | 100% | 327 | 100% | 919 | 100% | 2,379 | 100% |

CONSERVATION AREAS = DEFFERED OGEAS, NON DEFERRED OGEAS, RESERVED & MANAGED PAIR AREAS, AND RESIDUAL HABITAT AREAS.

SPECIAL MANAGEMENT AREAS = TPCC WOODLANDS, ACECS, RIPARIAN BUFFERS, RECREATION SITES, AND DISTRICT ALLOCATIONS.

CONNECTIVITY = CONNECTIVITY / DIVERSITY BLOCKS.

GEN. FOREST MGT. = GENERAL FOREST MANAGEMENT AREAS.

Figure B-1.

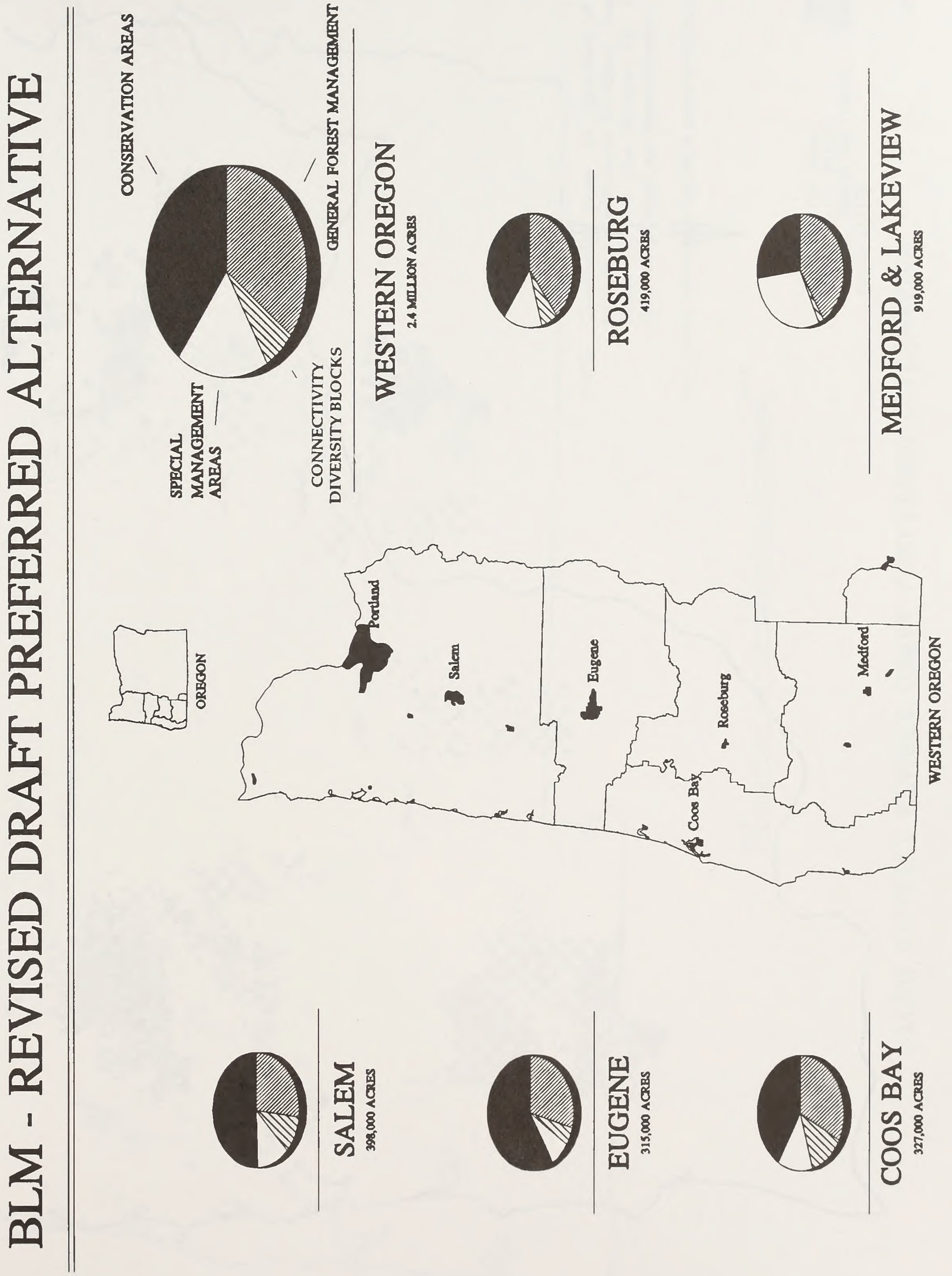
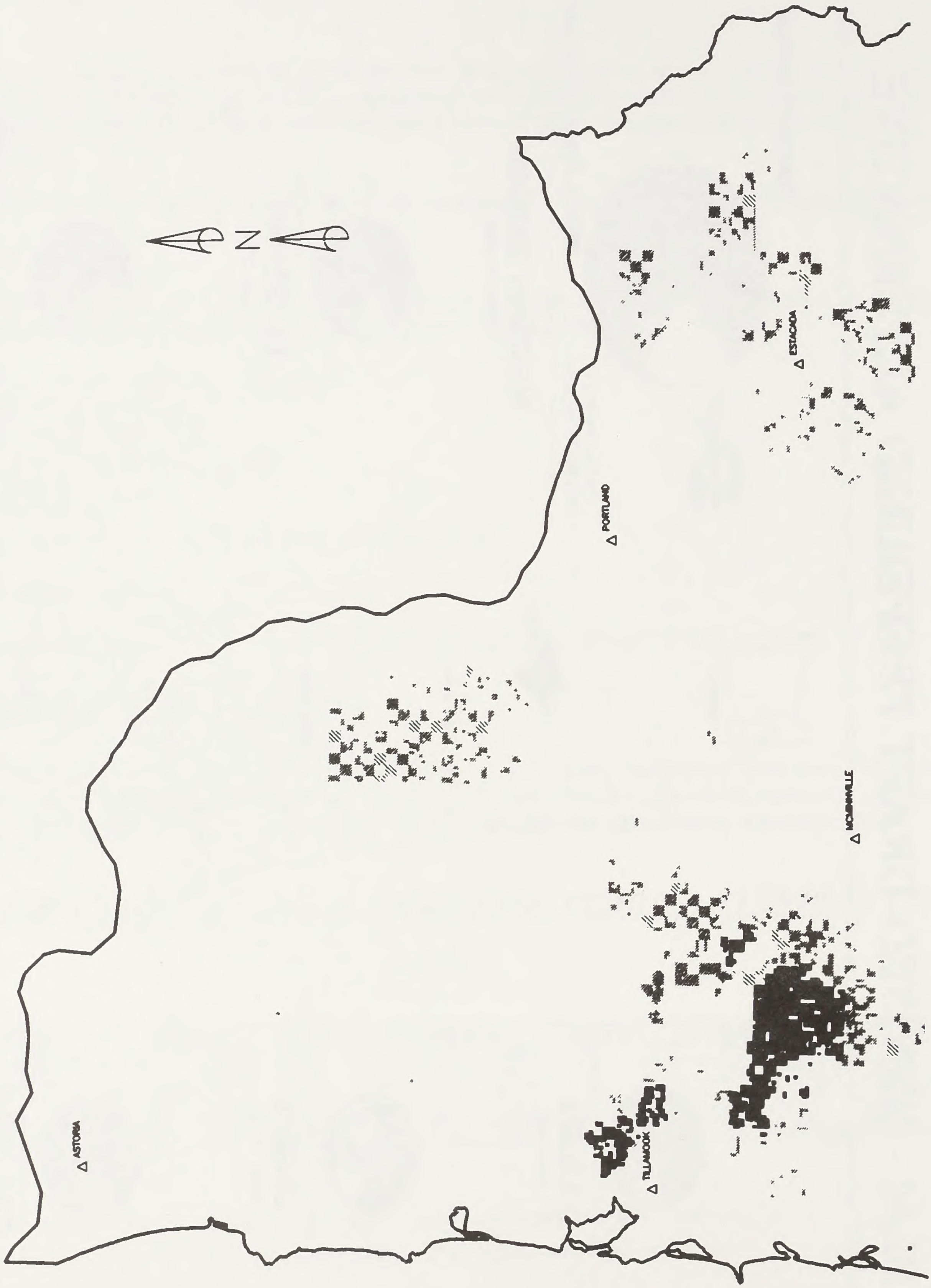
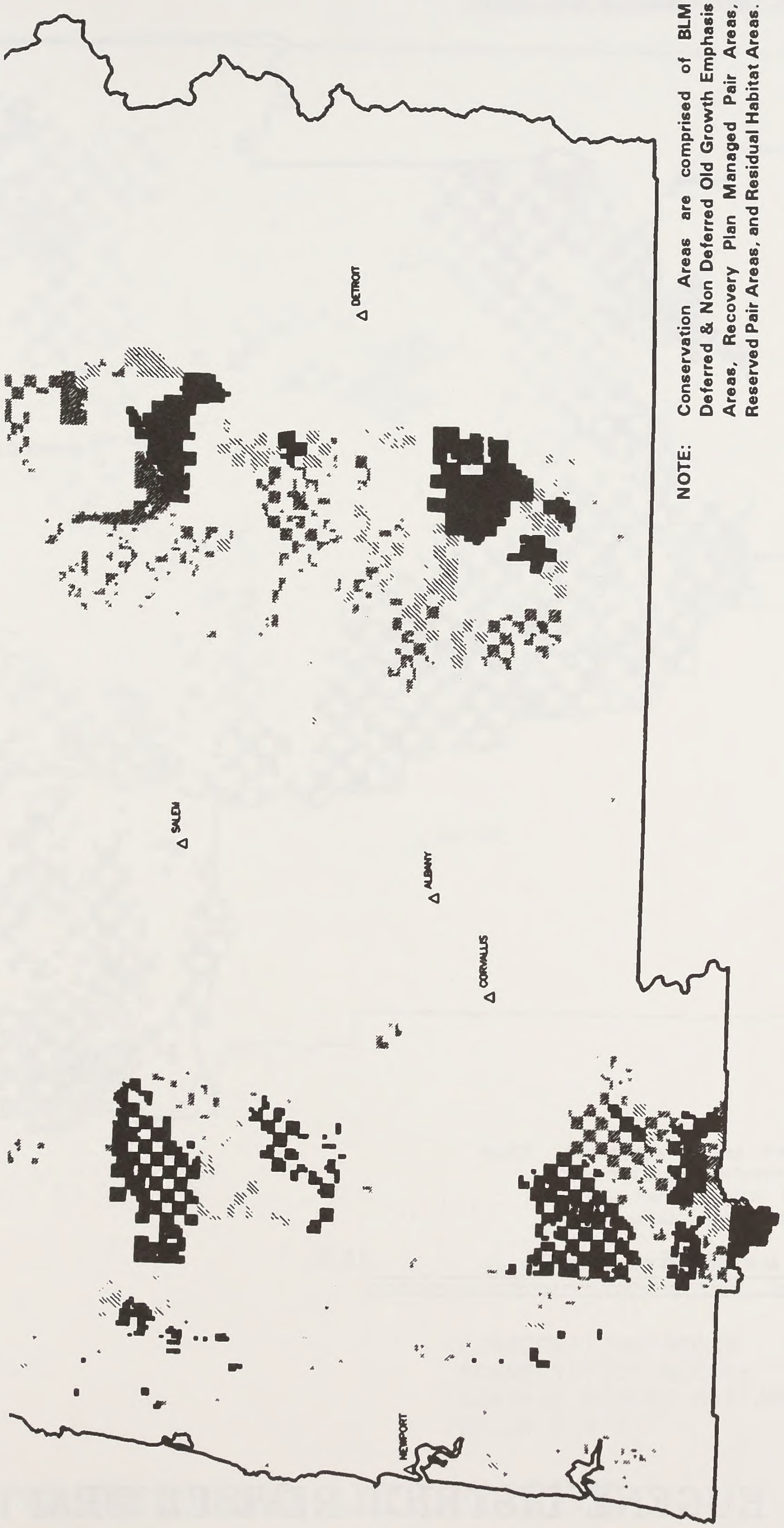

BLM - REVISED DRAFT PREFERRED ALTERNATIVE
CONSERVATION AREAS
GENERAL FOREST MANAGEMENT
SPECIAL MANAGEMENT AREAS
CONNECTIVITY DIVERSITY BLOCKS
WESTERN OREGON
2.4 MILLION ACRES
ROSEBURG
419,000 ACRES
MEDFORD & LAKEVIEW
919,000 ACRES
OREGON
Portland
Salem
Eugene
Roseburg
Coos Bay
Medford
WESTERN OREGON
SALEM
398,000 ACRES
EUGENE
315,000 ACRES
COOS BAY
327,000 ACRES

**Figure B-2. Salem District Revised Draft Preferred Alternative.**



## SALEM DISTRICT REVISED DRAFT PREFERRED ALTERNATIVE



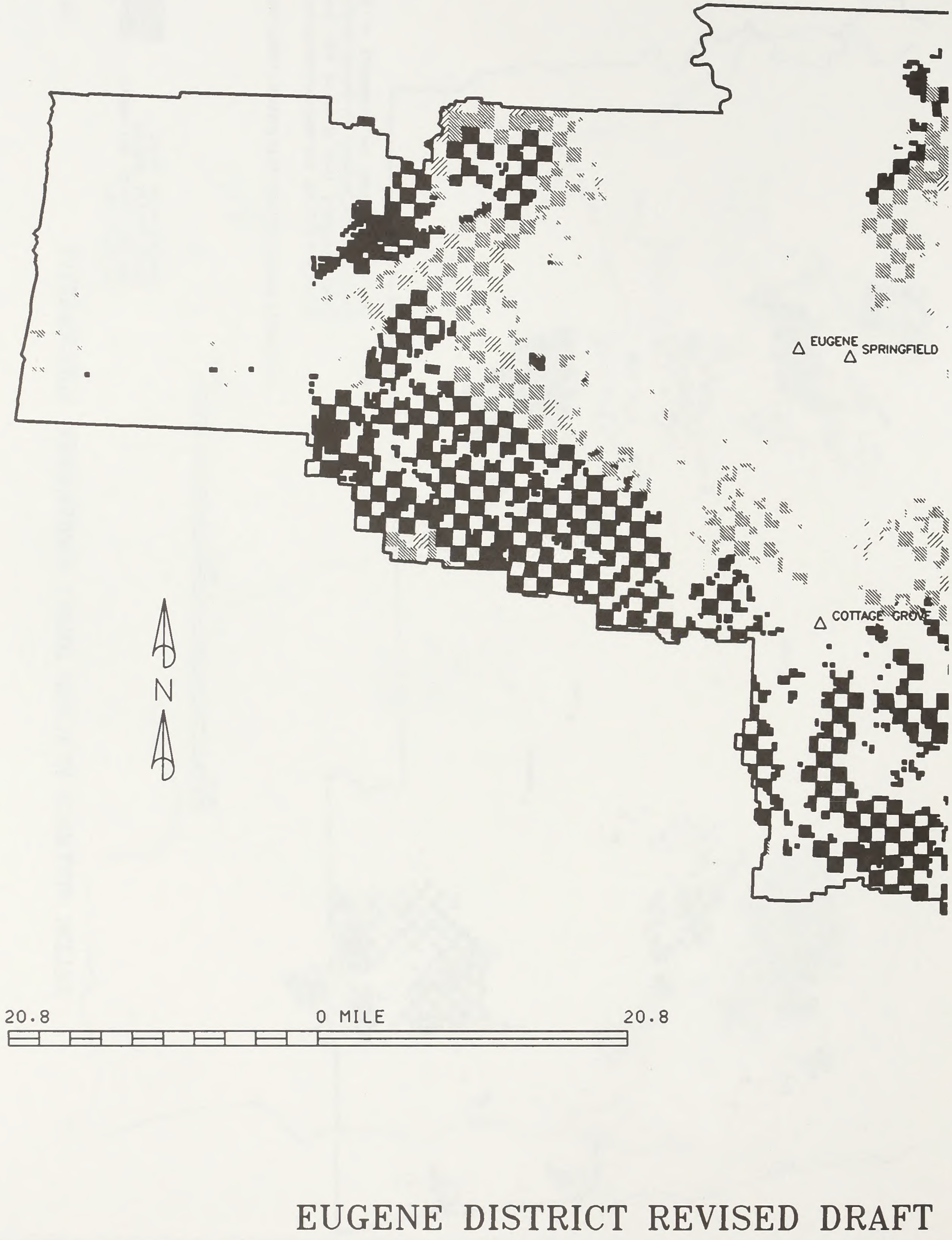
NOTE: Conservation Areas are comprised of BLM Deferred & Non Deferred Old Growth Emphasis Areas, Recovery Plan Managed Pair Areas, Reserved Pair Areas, and Residual Habitat Areas.

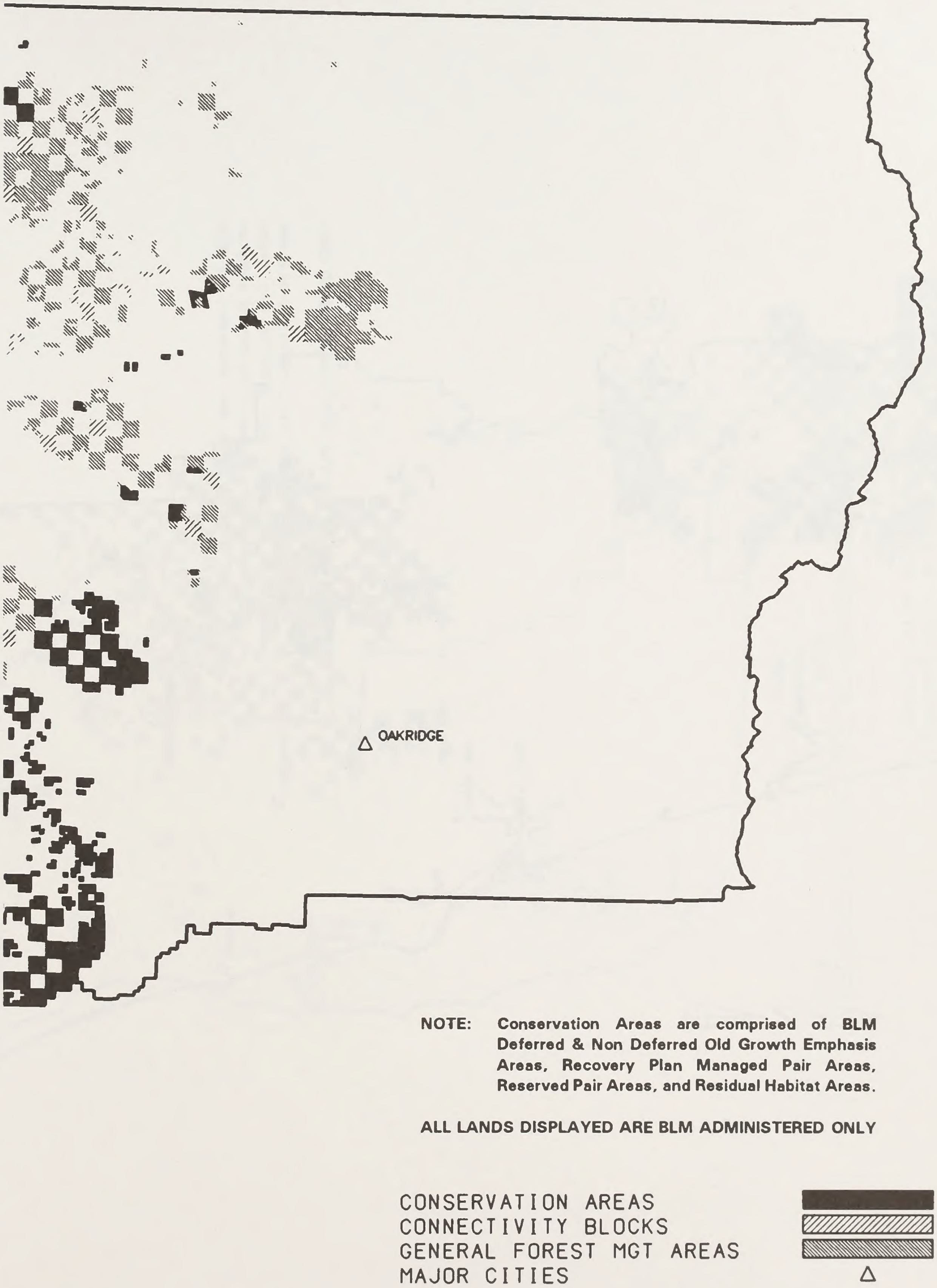
ALL LANDS DISPLAYED ARE BLM ADMINISTERED ONLY

| | |
|---|---|
| ■ | CONSERVATION AREAS |
| ▨ | CONNECTIVITY BLOCKS |
| ▦ | GENERAL FOREST MGT AREAS |
| △ | MAJOR CITIES |

JUNE 1993

Figure B-3. Eugene District Revised Draft Preferred Alternative.





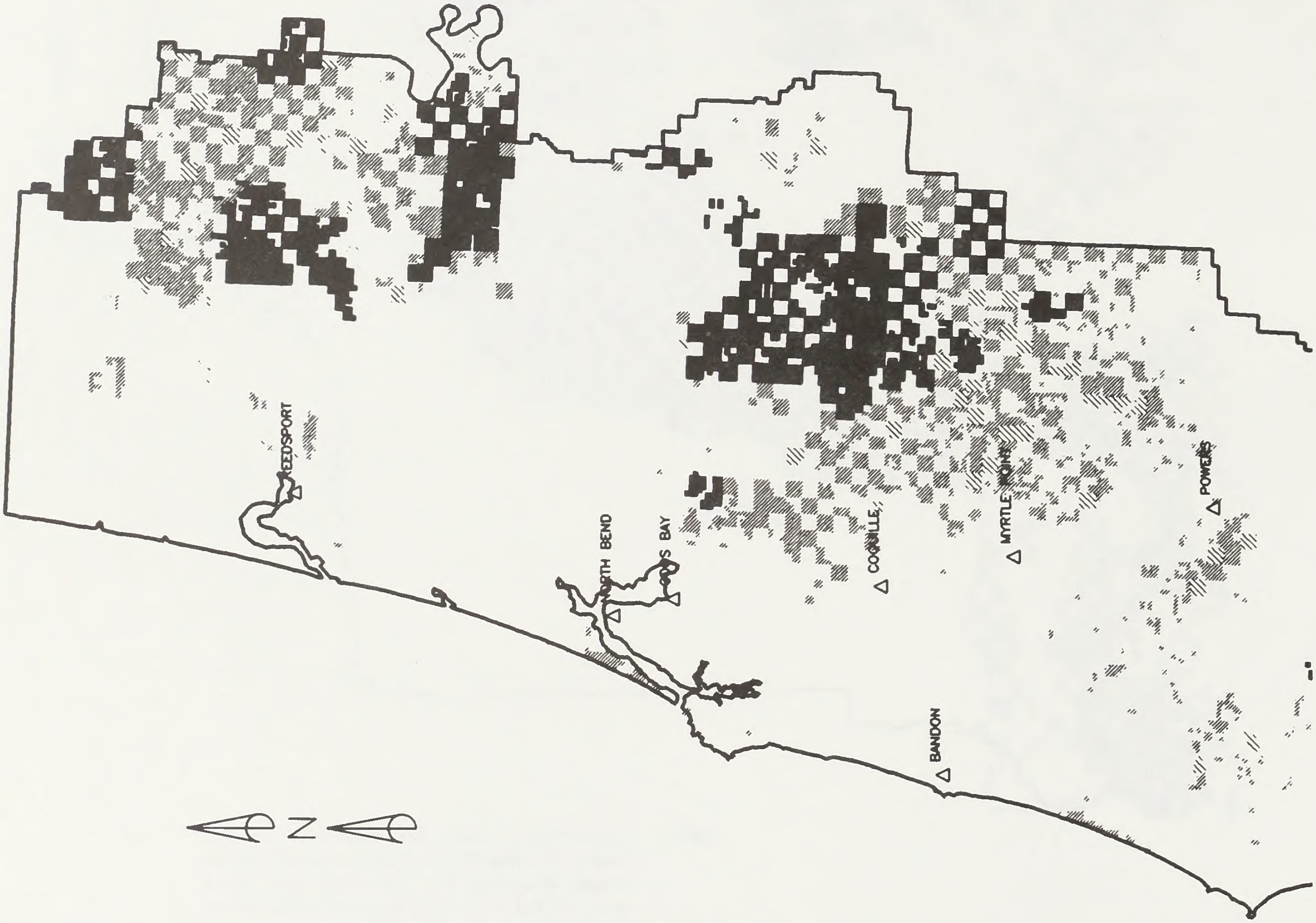
**NOTE:** Conservation Areas are comprised of BLM Deferred & Non Deferred Old Growth Emphasis Areas, Recovery Plan Managed Pair Areas, Reserved Pair Areas, and Residual Habitat Areas.

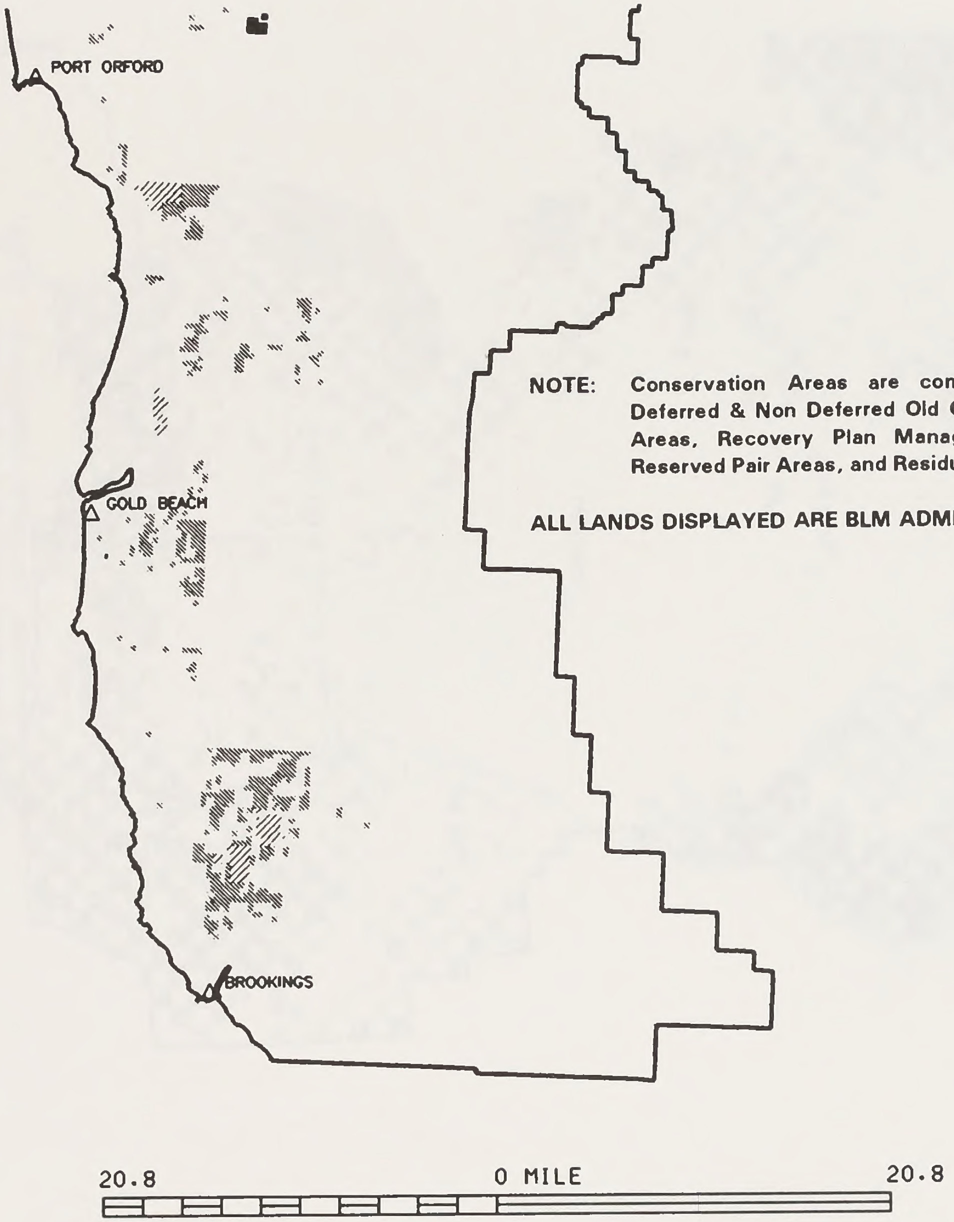
**ALL LANDS DISPLAYED ARE BLM ADMINISTERED ONLY**

PREFERRED ALTERNATIVE

JUNE 1993

**Figure B-4.** Coos Bay District Revised Draft Preferred Alternative.





**NOTE:** Conservation Areas are comprised of BLM Deferred & Non Deferred Old Growth Emphasis Areas, Recovery Plan Managed Pair Areas, Reserved Pair Areas, and Residual Habitat Areas.

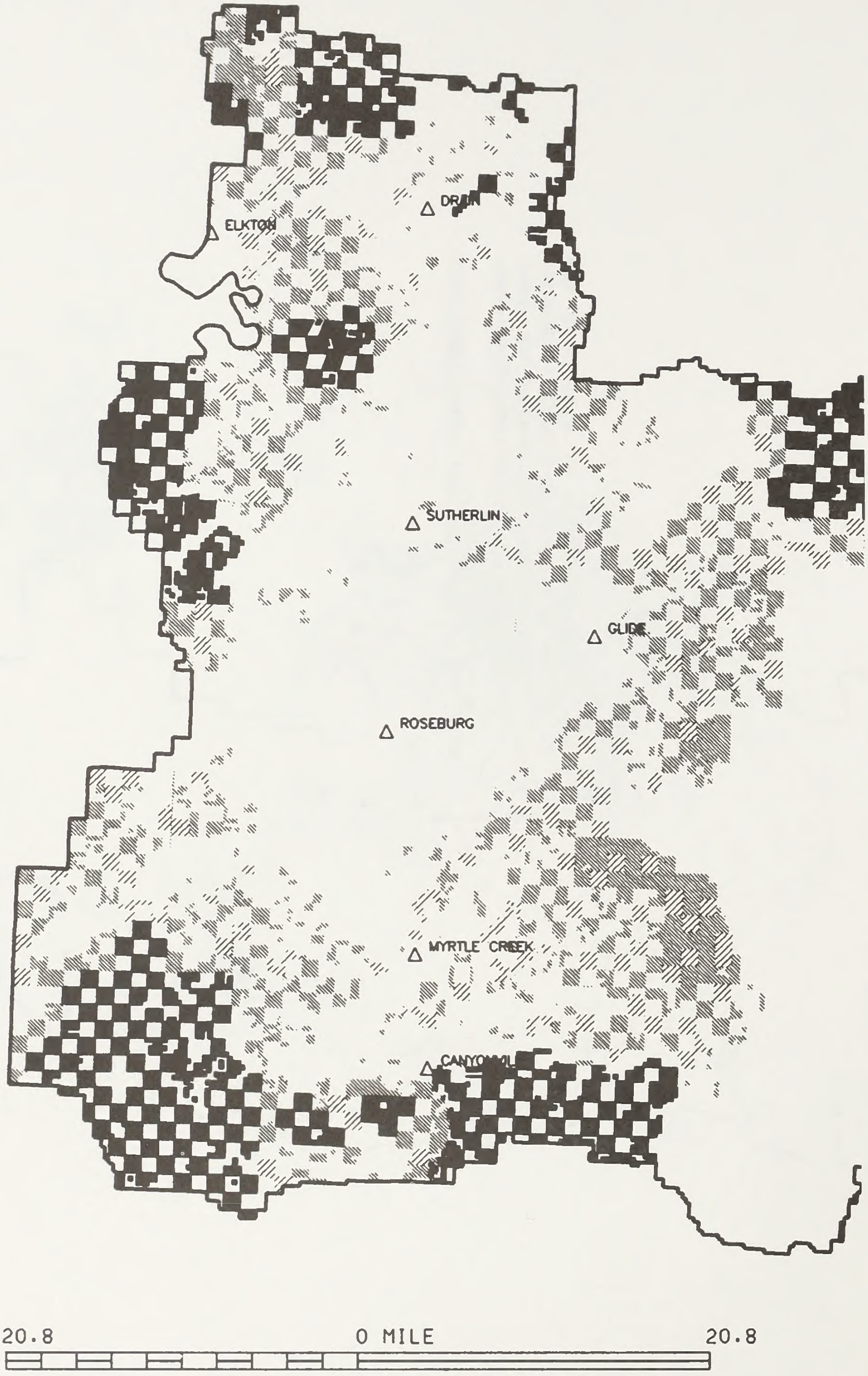
**ALL LANDS DISPLAYED ARE BLM ADMINISTERED ONLY**

| | |
|---|---|
| CONSERVATION AREAS | ■ |
| CONNECTIVITY BLOCKS | ▨ |
| GENERAL FOREST MGT AREAS | ▩ |
| MAJOR CITIES | △ |

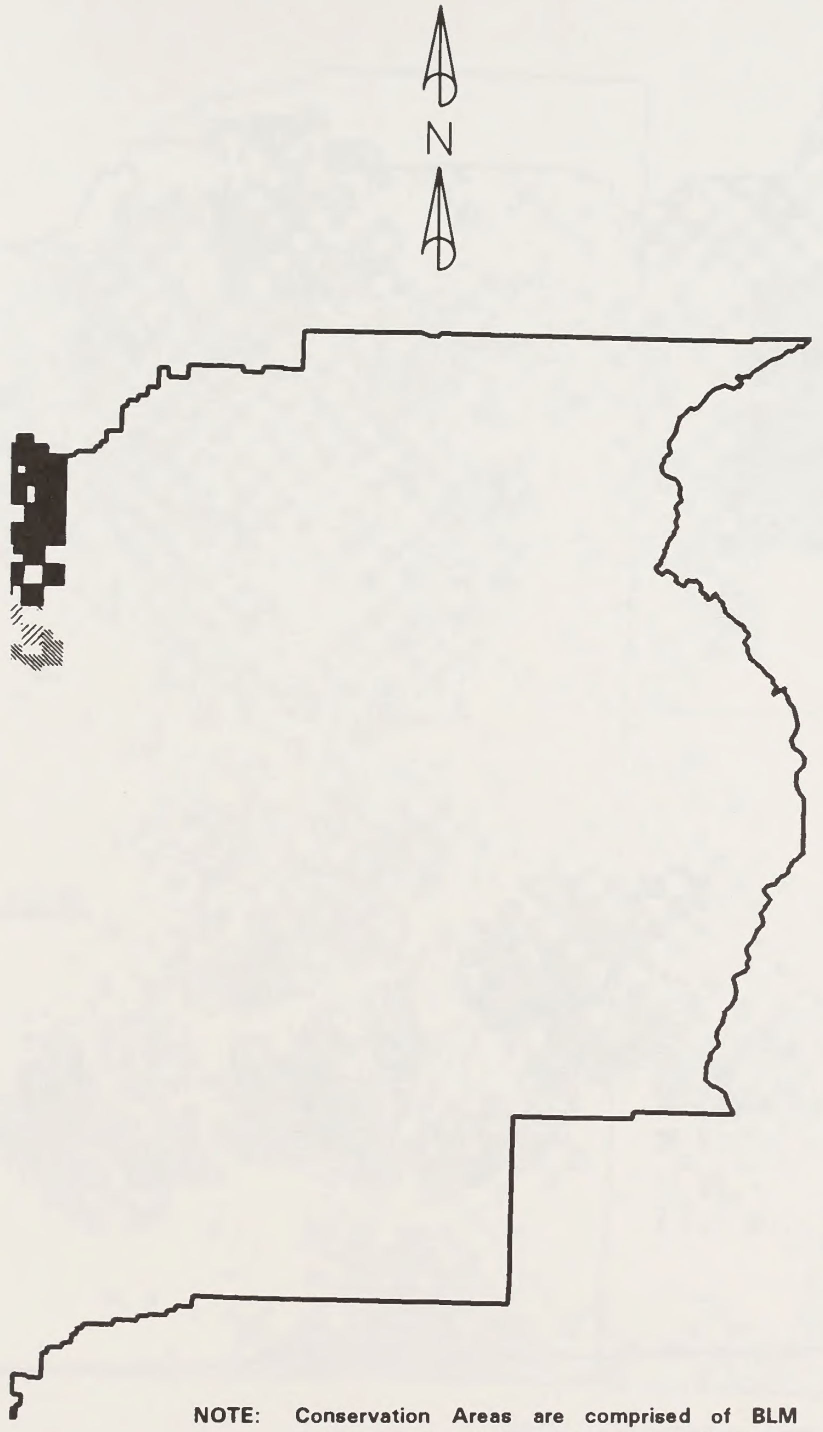
# COOS BAY DISTRICT REVISED DRAFT PREFERRED ALTERNATIVE

JUNE 1993

**Figure B-5. Roseburg District Revised Draft Preferred Alternative.**



ROSEBURG DISTRICT REVISED DRAFT



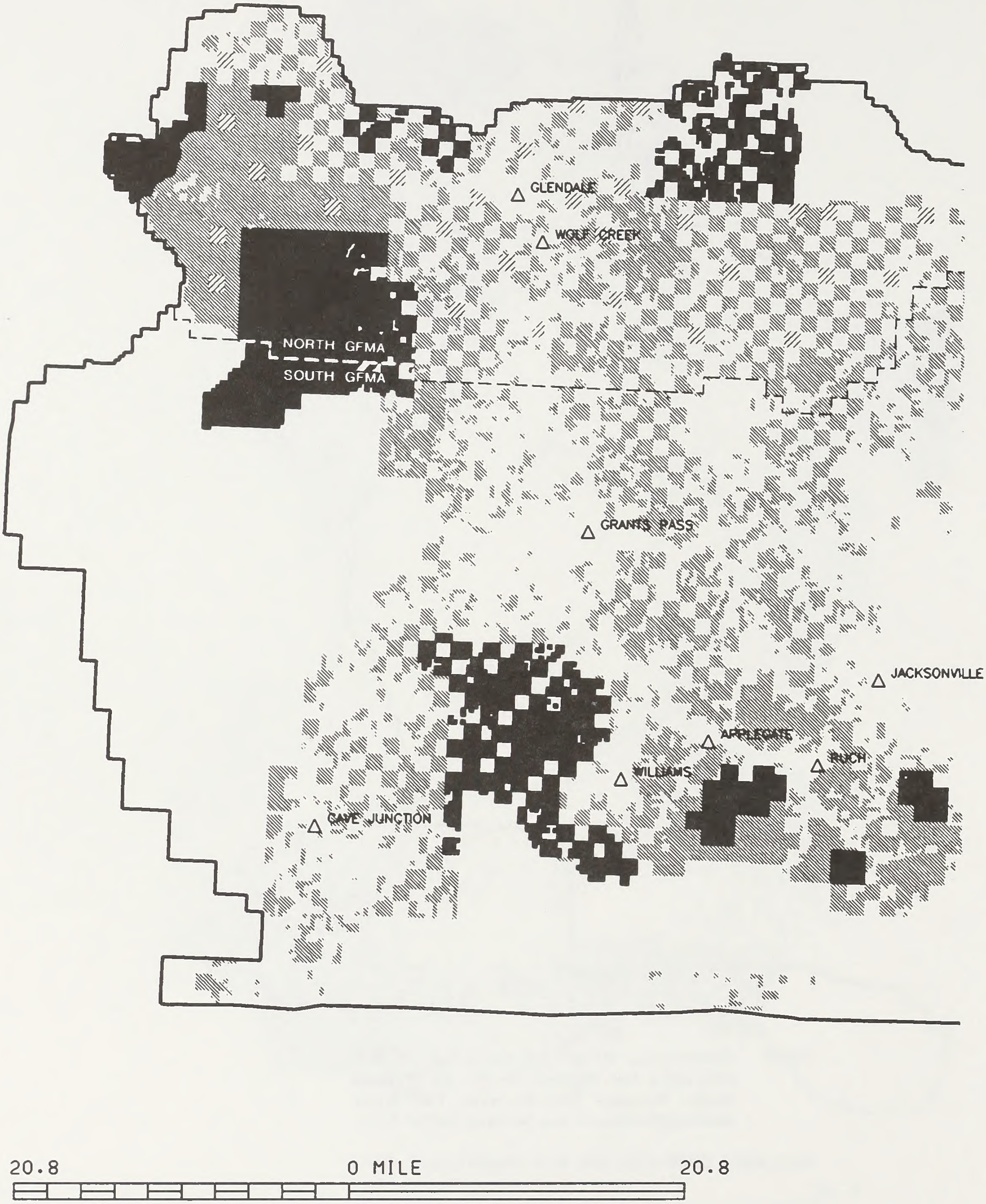
**NOTE:** Conservation Areas are comprised of BLM Deferred & Non Deferred Old Growth Emphasis Areas, Recovery Plan Managed Pair Areas, Reserved Pair Areas, and Residual Habitat Areas.

**ALL LANDS DISPLAYED ARE BLM ADMINISTERED ONLY**

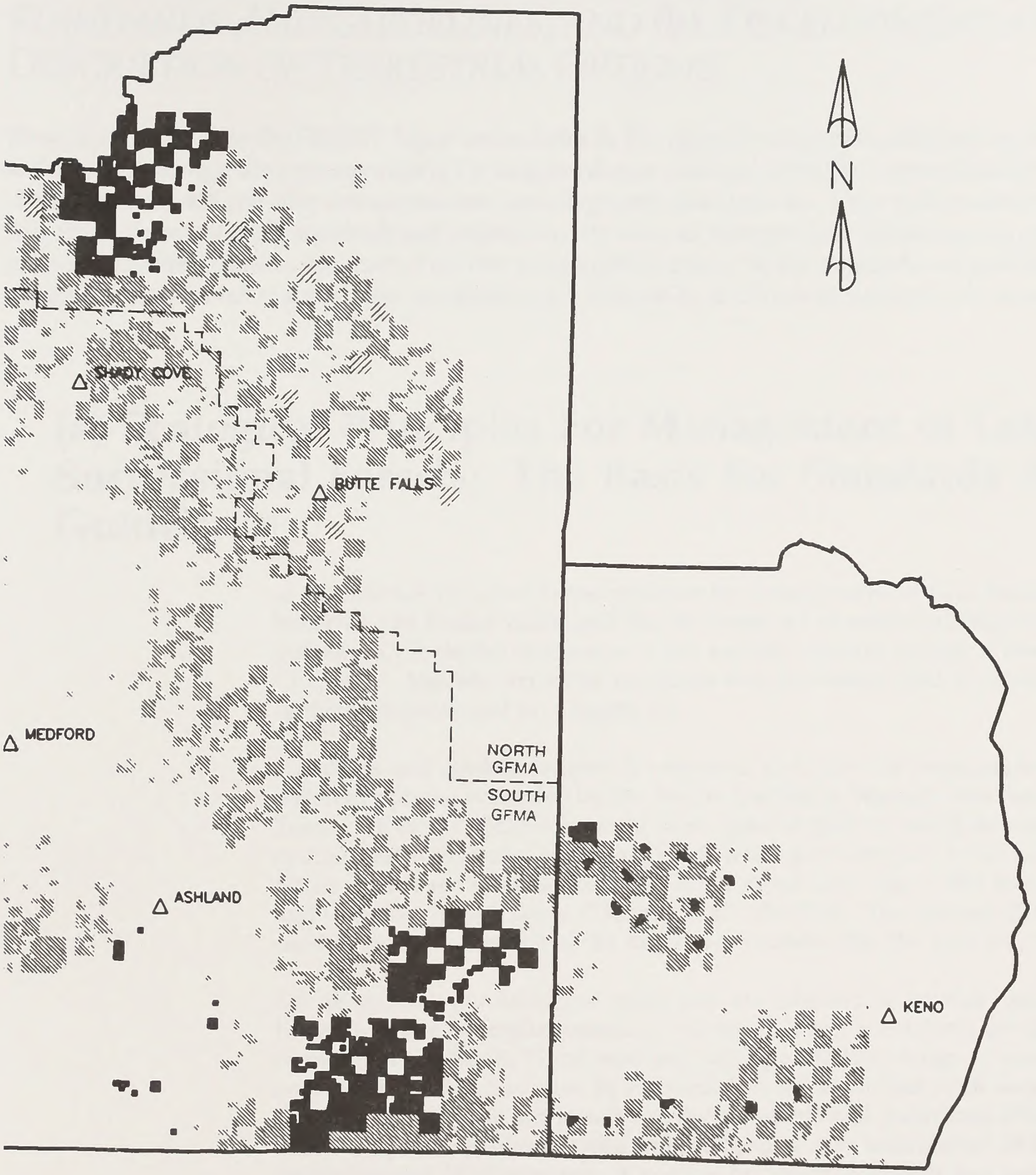
CONSERVATION AREAS ■
CONNECTIVITY BLOCKS ▨
GENERAL FOREST MGT AREAS ▩
MAJOR CITIES △

PREFERRED ALTERNATIVE JUNE 1993

**Figure B-6. Medford/Lakeview District Revised Draft Preferred Alternative.**



MEDFORD/LAKEVIEW DISTRICT REVISED



**NOTE:** Conservation Areas are comprised of BLM Deferred & Non Deferred Old Growth Emphasis Areas, Recovery Plan Managed Pair Areas, Reserved Pair Areas, and Residual Habitat Areas.

**ALL LANDS DISPLAYED ARE BLM ADMINISTERED ONLY**

| | |
|---|---|
| CONSERVATION AREAS | ■ |
| CONNECTIVITY BLOCKS | ▨ |
| GENERAL FOREST MGT AREAS | ▨ |
| MAJOR CITIES | △ |

## DRAFT PREFERRED ALTERNATIVE

JUNE 1993

# 2. PRINCIPLES FOR MANAGEMENT - (a) *ECOLOGICAL PRINCIPLES FOR MANAGEMENT OF LATE-SUCCESSIONAL FORESTS: THE BASIS FOR STANDARDS AND GUIDELINES, AND* (b) *DEVELOPMENT AND DESCRIPTION OF TERRESTRIAL OPTIONS.*

*These two sections from the FEMAT Report are included in this Appendix to provide additional information on objectives and assumptions regarding management of the designated areas managed primarily to protect and enhance habitat for the northern spotted owl and other late-successional and old-growth related species. These sections are important because they help clarify the intent of the standards and guidelines so the resource manager (and the interagency oversight team) can make correct interpretations whenever situations not specifically covered by the standards and guidelines arise. The first section discusses overall standards and guidelines and is followed by additional discussion in the terrestrial section.*

## (a) Ecological Principles For Management of Late-Successional Forests: The Basis For Standards And Guidelines

In this section we provide the rationale for management of Late-Successional Reserves and Matrix lands, and the development of terrestrial standards and guidelines. A similar discussion of the aquatic/riparian system is found in Chapter V. Specific terrestrial standards and guidelines used to develop the options are presented in Chapter III.

Standards and guidelines provide objectives and rules for management under different options evaluated by the Forest Ecosystem Management Assessment Team. All of the options have the same general goal: maintain late-successional species and ecosystems on federal lands while providing for social and economic needs. Late-successional forests are those forest seral stages that include mature and old-growth age classes (Thomas et al. 1993:510). The options differ in means used to reach that goal and the degree of certainty that the goal will be met.

For all options, standards and guidelines are intended to provide guidance during the early phase of implementation. However, forest ecosystems are quite variable throughout the Pacific Northwest and site-specific knowledge of ecosystems is best interpreted and applied by resource specialists familiar with local conditions. These specialists will aid in refining the standards and guidelines over time to adapt to specific planning areas and incorporate new information and improved understanding of ecosystems. A process by which standards and guidelines could be modified is described in Chapter VIII . Oversight groups would be responsible for interpretation of guidelines provided by any selected option, as well as review and approval of proposed modifications.

An important goal of forest management on the federal lands is to maintain biological diversity associated with native species and ecosystems in accordance with environmental laws and regulations. To meet this goal, the federal lands are viewed as an ecologically interdependent mosaic of ecosystems that is stratified into Congressionally Withdrawn Areas, Late-Successional Reserves, and Matrix.

In Late-Successional Reserves, standards and guidelines are designed to maintain late-successional forest ecosystems and protect them from loss to large-scale fire, insect and disease epidemics, and major human impacts. The intent is to maintain natural ecosystem processes such as gap dynamics, natural regeneration, pathogenic fungal activity, insect herbivore, and low-intensity fire. In some options, standards and guidelines encourage the use of silvicultural practices to accelerate the development of overstocked young plantations into stands with old forest characteristics, and to reduce the risk that Late-Successional Reserves will be severely impacted by large-scale disturbances and unacceptable loss of habitat.

The Matrix is an integral part of the conservation strategy included in all options. Production of timber and other commodities is an important objective for the Matrix. However, management must ensure that the forests in the Matrix provide for connectivity between Late-Successional Reserves and provide habitat for a variety of organisms associated with both late-successional and younger forests, and that ecosystem productivity is maintained. Standards and guidelines for the Matrix are designed to provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components such as down logs, snags, and large trees. The Matrix will also provide for ecologically diverse early-successional conditions.

## General Ecological Basis For Forest Management

Most options contain provisions to manage young forests to maintain or accelerate the development of attributes that are characteristic of late-successional forests, namely: (1) structure and composition, (2) ecological processes, and (3) ecosystem functions.

### Structure and Composition

The structure and composition of late-successional and old-growth forest ecosystems has been detailed in numerous publications ( e.g., Franklin et al. 1981; Spies and Franklin 1988; Spies and Franklin 1991). Franklin et al. (1981) identified four major structural attributes of old-growth Douglas-fir forests: live old-growth trees, standing dead trees (snags), fallen trees or logs on land, and logs in streams. Additional important elements typically include multiple canopy layers, smaller understory trees, canopy gaps, and patchy understory (Spies et al. 1990). Structural characteristics of old forests vary with vegetation type, disturbance regime, and developmental stage. For example, in many Douglas-fir stands in western Oregon and Washington the mature phase of stand development begins around 80 years with relatively large live and dead trees (Spies and Franklin in press), although multiple canopy layers may not yet be well developed. In some forest types subject to frequent, low-intensity fire, such as ponderosa pine, the late-successional and old-growth stages typically have relatively open understories and relatively few large fallen trees in comparison with more moist Douglas-fir/western hemlock types. We recognize that as structural and compositional characteristics of old forests vary among physiographic provinces, so necessarily will standards and guidelines intended to promote the desired conditions.

### Ecological Processes

Ecological processes include those natural changes that are central to the development and maintenance of late-successional and old-growth forest ecosystems. Although the processes that created the current late-successional and old-growth ecosystems are not completely understood, we do know that they include: (1) tree growth and maturation, (2) death and decay of large trees, (3) low to moderate intensity disturbances (e.g., fire, wind, insects, and disease) that create canopy openings or gaps in the various strata of vegetation, (4) establishment of trees beneath the maturing overstory trees either in gaps or under the canopy, and (5) closing of canopy gaps by lateral canopy growth or growth of understory trees. These processes result in forests moving through different stages of late-successional/old-growth conditions that may span 80 to 1,000 years for forests dominated by long-lived species.

Several authors have described these stages (Bormann and Likens 1979; Oliver 1981; Peet and Christensen 1987) and Spies and Franklin (in press) have expanded the descriptions to include the protracted nature of stand development in forests dominated by long-lived trees such as Douglas-fir. Following stand-replacement disturbance, these stages can be described as (1) establishment, (2) thinning, (3) maturation, (4) transition, and (5) shifting-gap.

The maturation stage (3) is characterized by a slowed rate of height growth and crown expansion. Heavy limbs begin to form and gaps between crowns become larger and more stable or expand from insect and pathogen mortality. Large dead and fallen trees begin to accumulate, and the understory may be characterized by seedlings and saplings of shade-tolerant tree species. In Douglas-fir stands west of the Cascades, this stage typically begins between 80 and 140 years, depending on site conditions and stand history.

During the transition stage (4), the original cohort of overstory trees approaches its maximum height and diameter and growth is slow. Tree crowns become more open and irregular in shape and contain heavy limbs, Broken, dead, and decaying portions of tree crowns are common. Old trees become relatively resistant to low to moderate intensity fire, and depending on species, crown bases are high above the understory and bark is relatively thick. During this stage, understory trees form multiple canopy layers, coarse woody debris accumulates to relatively high levels, and low to moderate intensity disturbances from insects, disease, wind, and fire create patchy openings and accumulations of standing dead trees. These disturbances also frequently promote establishment or advancement of understory trees that eventually fill the holes in the canopy. In Douglas-fir stands west of the Cascades, this stage begins between 150 to 250 years and may last for an additional 300 to 600 years depending on site conditions and species.

The shifting-gap stage begins when the last of the original cohort of overstory old-growth trees dies and all trees in the canopy have established following smaller gap-type disturbances of various types. Forests in the last two stages (4 and 5) of development actually contain all of the stand developmental stages in a relatively fine-grained mosaic of smaller stands. The later three stages (3, 4, and 5) embody the late-successional/old-growth conditions that are the focus of this report.

Some of the stand developmental processes, such as tree growth and mortality, and understory establishment, can be accelerated through silvicultural manipulations. Most options provide for the acceleration of these processes in younger stands. Other processes such as maturation of tree crowns, thickening of bark, and decay of tree boles are not readily accelerated through silviculture. Because of our limited knowledge of late-successional and old-growth processes and lack of silvicultural experience in old stands, it is by no means certain that we can create old-growth ecosystem conditions.

Most of the current late-successional and old-growth stands developed from natural regeneration following wildfire that occurred during the last 500 to 600 years and covered large areas--frequently many thousands of acres. Although these fires were large, they were patchy and left many areas of unburned or lightly burned forest. The natural regime of patchy fires that leave an abundance of large dead trees and lesser amounts of scattered live trees, as individuals and in patches, is the basis for silvicultural methods such as retention of green trees as individuals and in patches.

In some cases, however, natural reburns occurred, resulting in relatively little carryover of live trees as a legacy from the old-growth condition. Where considerable live and dead material was left following fires, young stands contained many old-growth structures and presumably old-growth-associated organisms, including organisms associated with coarse woody debris on the forest floor.

Large fires and relatively long fire return intervals in the moist northern and western physiographic provinces resulted in periods during which landscapes contained large areas of relatively unbroken forest cover. In the warmer, drier physiographic provinces (e.g., Eastern Cascades and Klamath Provinces), fire is more frequent, less intense, and more a part of the internal dynamics of what is typically considered a stand (e.g., tens to hundreds of acres). In the drier provinces, fire control and timber harvest have decreased the abundance of some types of old-growth, such as ponderosa pine, that are dependent on frequent, low-intensity fires. Other types of late-successional forest that are less fire resistant or are less desirable for harvest have become more widely distributed. In these areas, the potential for stand replacement wildfires has increased, resulting in a higher risk to the stability of current stands reserved for late-successional species.

At a landscape-scale and over long periods, stand replacing wildfires have an important role in resetting successional processes and developing new areas of late-successional forests to replace those lost through succession or disturbance. Silvicultural practices, designed to imitate natural processes may be able to reset succession to achieve stand and landscape level goals. This type of silviculture holds promise to meet a variety of ecosystem objectives, however we have very little experience in applying silviculture for late-successional objectives. Until we gain more experience and knowledge about active management to produce late-successional ecosystems, sustaining late-successional ecosystems in the landscape will be best accomplished through retention of existing areas of late-successional forest. Given the relatively low remaining proportion of late-successional ecosystem in the landscape at the present time, these older forests should be protected from fire and other "resetting" disturbances.

## Ecosystem Functions

Late-successional ecosystems perform several ecological functions that appear to be lacking, or less well developed, in younger natural forests and managed plantations. These functions include buffering of microclimate during seasonal climatic extremes (Chen et al. 1993), producing food for those consumer organisms which occupy late-successional forests (Ure and Maser 1982; Huff et al. 1991), storing carbon (Harmon et al. 1990), nutrient and hydrological cycling (Franklin and Spies 1991), and providing sources of arthropod predators and organisms beneficial to other ecosystems or successional stages (Schowalter 1989). Old-growth ecosystems appear to be highly retentive of nutrients (Sollins et al. 1980) and low in soil erosion potential (Swanson et al. 1982) although differences in these functions between stand developmental stages may not be large when canopy closure has occurred. Tall, deep canopies of late-successional forests can intercept more moisture from clouds and fog than young plantations (Harr 1982).

# Categories of Late-Successional Forest Conservation Areas

Any plan that does not maintain a strong network of existing old-forest ecosystems risks losing known and unknown biodiversity associated with old forests. Therefore, all management options include Reserves designed to maintain and enhance late-successional forests. Although their size, distribution, and management varies among options, these Reserves include two general categories, as follows.

## Late-Successional Reserves

These Reserves represent a strong network of existing old forests that are retained in their natural condition, with natural processes such as fire allowed to function to the extent possible. These Reserves are designed to serve several functions. First, they provide a distribution, quantity, and quality of old-forest habitat sufficient to avoid foreclosure of future management options. Second, they provide habitat for viable, well-distributed populations of species including the northern spotted owl and marbled murrelet that are associated with late-successional forests. Third, they will help ensure that the full range of late-successional biodiversity will be conserved. Currently, Reserves contain significant areas dominated by early successional communities. However, late-successional communities and associated species will become more abundant as younger stands mature.

Late-successional forest communities are the result of a unique interaction of disturbance, regeneration, succession, and climate that probably can never be created with management. At present, we do not even fully understand the structure, species composition, and function of these forests. The best we can hope to accomplish through silviculture is to at least partially restore or accelerate the development of some of the structural and compositional features of such forests. Because they will be regenerated by different processes during a different period from that of the existing late-successional forests, it is highly likely that silviculturally created stands will look and function differently from current old stands that developed over the last 1,000 years. Consequently, conserving a network of natural old-growth stands is imperative for preserving biodiversity into the future.

Most options allow management of stands within Late-Successional Reserves to maintain, or accelerate the development of, late-successional forest conditions. In general, management would be limited to young stands, removal of hazard trees, and salvage of limited amounts of dead trees after fires, windstorms, or insect-caused mortality.

A variety of areas currently remaining unmapped would be managed as Late-Successional Reserves. These areas include LS/OG3s (Johnson et al. 1991) and murrelet sites within the Matrix. Options 1-6, 9 and 10 included protection for murrelets and assumed that sites occupied by murrelets would be retained as Late-Successional Reserves once they were identified and mapped. LS/OG3s were retained as Late-Successional Reserves under option 1, were at least partially retained under options 3 and 4, and were released for harvest under other options. Where the LS/OG3 areas were retained as Late-Successional Reserves, the intent was to further strengthen the network and diversity of late-successional forest. We assumed that all of these areas would be mapped during the planning and implementation process for the selected option.

### Managed Late-Successional Areas

We assume that all late-successional forests will, at one time or another in the future, be subjected to ecological disturbance such as fire, wind, insects, or disease. Given this assumption, we believe it is reasonable to initiate silvicultural experiments that are likely to produce stands that are similar in structure to existing old stands. While these replacement stands may never be duplicates of existing old stands, we hypothesize that they will provide for most of the species and processes that occur in natural stands and will be adapted to current and future climate.

We proposed some options that allow management in some Reserves so that managers and researchers will experiment and gain experience with a more dynamic approach to maintenance of older forests on the landscape, while at the same time extracting some wood products. Research, monitoring, and adaptive management will have to occur simultaneously if we are going to understand how well we can expect to duplicate late-successional forest conditions within managed forest landscapes.

Some options examined by the Forest Ecosystem Management Assessment Team contained provisions for timber harvest through the use of long rotations in some Late-Successional Reserves. The objective of long rotations is to re-create, to the extent possible, the structural and compositional features of late-successional forests. Some of these features include: (1) multispecies and multilayered assemblages of trees, (2) moderate to high accumulations of large logs and snags, (3) moderate to high canopy closure, (4) moderate to high numbers of trees with physical imperfections such as cavities, broken tops, and large deformed limbs, and (5) moderate to high accumulations of fungi, lichens, and bryophytes. Although they may not be duplicates of existing old forests, we do believe that in the long term these stands could provide adequate habitat for some species.

## Role of Silviculture

Silviculture is the art and science of managing forest stands to provide or maintain structures, species composition, and growth rates that contribute to forest management goals. Silvicultural practices will vary considerably throughout the Pacific Northwest because of the broad variety of forest species and ecosystems in this region. The ecosystems range from coastal temperate rain forests where fire occurs infrequently but where wind may have a major impact, to forests on dry interior sites where disturbance by natural fire and insects is common. Within specific locales the silvicultural practices will be strongly influenced by such factors as nearby residential areas, local wildlife habitat requirements, and fire management constraints.

To develop silvicultural systems, it is important to have clear objectives for stand structure and species composition. Under most options, silviculture systems proposed for Late-Successional Reserves have two principle objectives (Tappeiner et al. 1992): (1) development of old-forest characteristics including snags, logs on the forest floor, large trees, and canopy gaps that enable establishment of multiple tree layers and diverse species composition; and (2) prevention of large-scale disturbances by fire, wind, insects, and diseases that would destroy or limit the ability of the Reserves to sustain viable forest species populations. Small-scale disturbances by these agents should continue.

Matrix objectives for silviculture should include: (1) production of commercial yields of wood, including those species such as Pacific yew and western red cedar that require extended rotations, (2) retention of moderate levels of ecologically valuable old-growth components such as snags, logs, and relatively large green trees, and (3) provision of ecologically diverse early-successional conditions.

## Stand Management

Forests within Late-Successional Reserves are composed of managed stands from 2 to over 50 years of age as well as unmanaged, late-successional, and old-growth stands. The younger stands were usually established following fire or timber harvest. Some of these stands will develop old-growth characteristics without silvicultural intervention. However, current stocking and structure of some of these stands were established to produce high yields of timber, not to provide for old-growth-like forests. Consequently, silviculture can accelerate the development of young stands into multilayered stands with large trees and diverse plant species and structures that may in turn maintain or enhance species diversity.

Under most options, stand management in Late-Successional Reserves is proposed to focus on stands that have been regenerated (by clearcutting, shelterwood, and group or single tree selection methods) following timber harvest or on stands that have been thinned. These include stands that will acquire old-growth-like characteristics more rapidly with treatment, or are prone to fire, insects, disease, wind, or other variables that would jeopardize the reserve. Depending upon stand conditions, treatments could include, but not be limited to: (1) thinning or managing the overstory to produce large trees, release advanced regeneration of conifers, hardwoods, or other plants, or to reduce risk from fire, insects, disease, or other environmental variables; (2) underplanting and limited understory vegetation control to begin development of multistory stands; (3) killing trees to make snags and logs on the forest floor; (4) reforestation; and (5) use of prescribed fire.

Tappeiner et al. (1992) discussed management of forest stands for northern spotted owl habitat, including examples of silvicultural systems and treatments that resemble natural forest disturbances. Their discussion can provide initial guidance for silvicultural treatment of young stands in Late-Successional Reserves.

Stands in the Matrix can be managed for timber and other commodity production, but they also have an important role in maintaining biodiversity. Silviculture systems for stands in the Matrix should provide for retention of old-growth ecosystem components such as large green trees, snags and down logs, and depending upon site and forest type, a diversity of species.

All options evaluated provide for retention of varying numbers of green trees following timber harvest in the Matrix, to provide a legacy bridging past and future forests. Retained green trees serve several important functions including snag recruitment, promoting multi-storied canopies, and providing shade and suitable habitat for many organisms in the Matrix.

Options 3 and 9 call for retention of green trees in well-distributed patches as well as dispersed individuals. Patches of green trees of various sizes, ages, and species will promote species diversity and may act as refugia or centers of dispersal for many organisms including plants, fungi, lichens (Esseen et al. 1992), small vertebrates, and arthropods.

Patches of trees may also provide protection for special microsites such as seeps, wetlands, or rocky outcrops. Trees retained within riparian protection areas can contribute to retention objectives but will generally not be sufficiently dispersed across the landscape to fully satisfy these objectives.

Diversity of tree structure should be considered when selecting trees for retention. Complex canopy structure and especially leaning boles are beneficial for some lichens (Esseen et al. 1992). Trees that are asymmetrical provide a diversity of habitat substrates and often have more lichen and moss epiphytes on large lateral limbs than symmetrical trees. Location of green trees is also important ( e.g., ridgelines are optimum locations for lichen dispersal).

Large logs of a variety of decay classes should be left. All down logs in advanced stages of decay (class 3-5) and significant quantities of less decayed logs (class 1-2) should be retained. Down log guidelines will differ between forests west of the Cascades and those in the Eastern Cascade or Klamath Provinces primarily because of fundamental differences in ecosystems (e.g., climate, vegetation, fire frequency and severity).

Coarse woody debris is essential for many species of vascular plants, fungi, liverworts, mosses, and lichens, arthropods, salamanders, reptiles and small mammals. Because of drier microclimates, logs in the Matrix may be occupied by species different from those found on coarse woody debris in late-successional forests. However, these logs may provide transitional islands in successional time for the maintenance and eventual recovery of some late-successional organisms in the Matrix.

In the Matrix, levels of snags should be retained that are adequate to support viable populations of cavity nesters. Management for 40 percent of potential populations of cavity nesters may be the minimum required for viability of these species within the Matrix (Thomas et al. 1979). However, considerable research and monitoring will be required to determine actual levels of snags required to support viable populations of various species in different provinces. Snags could be created in Matrix stands if they are lacking, but there is much uncertainty concerning the efficacy of killing trees to provide snags.

Adequate numbers of large snags and green trees are especially critical for bats because they are used for maternity roosts, temporary night roosts, day roosts, and hibernacula. Large snags and green trees should be well distributed throughout the Matrix because bats compete with primary excavators and other species that use cavities. Day and night roosts are often located at different sites, and migrating bats may roost under bark in small groups. Thermal stability within a roost site is important for bats, and large snags and green trees provide that stability. Individual bat colonies may use several roosts during a season as temperature and weather conditions change. Large, down logs with loose bark may also be used by some bats for roosting.

Local information should be used to refine requirements for quantity, size, spacing, and distribution of snags and down logs. Guides for the retention of snags and down logs must be responsive to safety considerations during logging and other forest operations.

Thinning prescriptions should encourage development of diverse stands with large trees and a variety of species in the overstory and understory. Prescriptions should vary within and among stands.

## Management of Disturbance Risks

Natural disturbance is an important process within late-successional forest ecosystems but humans have altered disturbance regimes. Management may be required to re-introduce natural disturbance such as fire or to minimize socially unacceptable impacts.

Fire suppression has resulted in significant increases in accumulated fuels within some forests, particularly in the Eastern Cascades Province of Washington and Oregon and in the Klamath Province of southern Oregon and northern California (Agee 1990; Deeming 1990; Kauffman 1990). At the same time, these forests may have become much more vulnerable to insects and diseases (Mitchell 1990; Wickman 1992; Mutch et al. 1993).

In Late-Successional Reserves in the Western Cascades and coastal areas of Oregon and Washington, manipulation of natural stands to reduce fire hazard is generally not necessary (Agee and Edmonds 1992). However, fuel management may be desirable in plantations. An aggressive fire control strategy should be implemented, with emphasis on fire detection and initial attack (Agee and Edmonds 1992). In the future, fires may be allowed to burn, at least under some conditions. However, until we have fire management plans, all fires in west-side Late-Successional Reserves should be suppressed.

In Late-Successional Reserves in the Eastern Cascades or Klamath Provinces, silviculture aimed at reducing the risk of stand-replacing fires may be appropriate. Treatments may include thinning, underburning, and establishment of fuelbreaks. With fire suppression, some forests have become quite dense and multistoried, primarily from the invasion of shade tolerant species (Tappeiner et al. 1992). Reduction in mid-level canopy layers by thinning may reduce the probability of crown fires. Also, underburning can be used to reduce fuel loads and vertical fuel continuity. Wildfires entering underburned stands generally are less severe and direct control is often possible. To be effective, underburning should be implemented over large areas (Agee and Edmonds 1992).

Fuelbreaks compartmentalize management units by creating zones of reduced fuel, which allow safe access for fire suppression crews and provide a reasonable location for control. Fuelbreaks are generally located along ridgelines with continuous fuels. Stands are manipulated to reduce continuity of canopies, boles are pruned on residual trees, and significant quantities of understory fuels are removed (Agee and Edmonds 1992). Many of these treatments may reduce the quality of habitat for late-successional organisms. Thus, managers need to seek balance in an approach that reduces risk of fire while at the same time protects large areas of fire-prone late-successional forest.

Silvicultural systems within the Matrix contribute to management of the Late-Successional Reserves. Matrix management should reduce the risk of fire and other large-scale disturbances that would jeopardize the reserves. For example, fire and fuels management in the Matrix are compatible with management objectives for Late-Successional Reserves when they reduce the risk of fire entering the Reserves from adjacent managed lands.

Harvesting trees immediately adjacent to Late-Successional Reserves may result in increased wind damage along boundaries. In such cases, "feathering" stands within harvest units may be appropriate to reduce this risk. Local expertise will be essential in designing meaningful strategies for wind protection (Agee and Edmonds 1992).

## Management After Natural Disturbance

Fire, wind, insects, and disease have greatly influenced the development of Pacific Northwest forests (Agee 1990, 1991; Kauffman 1990; Agee and Edmonds 1992). Fine-scale disturbances, generally insects or disease, include deaths of single trees or small groups of trees which result in small patches of early successional vegetation embedded in a larger portion of older forest. Coarse-scale disturbances, such as fire and wind, result in more extensive areas of early seral vegetation. Many native forest organisms have adapted to these cycles and scales of disturbance and regrowth.

Most options have provisions for management following natural disturbances in Late-Successional Reserves. Management objectives should focus on either simulating natural succession or allowing it to occur unimpeded. Direct silvicultural management will usually be more appropriate following coarse-scale disturbances such as extensive, hot fires that kill most or all trees within a large area. Fine-scale disturbances will generally not require such management. In fact, insects, disease, and wind create small gaps in the overstory that characterize the transition and shifting-gap stages of old-growth forest development (Spies and Franklin 1989; Spies et al. 1990). The processes leading to formation of these gaps should not be impeded.

Tree mortality is an important and natural process within a forest ecosystem. Diseased and damaged trees and logs are key structural components of late-successional and old-growth forests (Franklin and Spies 1991; Spies and Franklin 1991). Accordingly, management planning for Late-Successional Reserves must acknowledge the considerable value of retaining dead and dying trees in the forest.

Salvage of dead trees has significant effects on the development of future stands and their suitability as habitat for a number of organisms. Snag removal results in long-term impacts on the forest community because large snags are not produced by the new stand until trees become large and begin to die from natural mortality (often a period of 50-100 years). Snags are used extensively by cavity nesting birds and mammals such as woodpeckers, nuthatches, chickadees, squirrels, red tree voles, and American marten (Carey et al. 1991; Gilbert and Allwine 1991a, b; Lundquist and Mariani 1991; Thomas et al. 1993). Removal of snags following disturbance can significantly reduce the carrying capacity for these species for many years.

Down logs are important components of forest ecosystems. They provide habitat for a broad array of vertebrates, invertebrates, fungi, mosses, vascular plants, and micro-organisms. Arthropods, salamanders, reptiles, and small mammals live in or under logs; woodpeckers forage on them; vascular plants and fungi grow on rotting logs (Harmon et al. 1986, Thomas et al. 1993).

Because of the important role of dead wood in late successional and old-growth forest ecosystems, and because there is much to learn about the role of dead wood in the development of forests, only limited salvage is appropriate in Late-Successional Reserves. Salvage policies of options generally ranged from no salvage to limited salvage as permitted by the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992c). This plan would allow removal of small-diameter snags and logs but would also require retention of snags and logs likely to persist until the new stand begins to contribute significant quantities of coarse woody debris.

Many natural disturbances do not result in complete mortality of stands. For example, recent fires in the Western Cascades of Oregon killed only 25-50 percent of trees within the areas burned (USDA 1988, 1989, 1992). The surviving trees are important elements of the new stand. They provide structural diversity and a potential source of additional large snags during the development of new stands. Furthermore, trees injured by disturbance may develop cavities, deformed crowns, and limbs that are important habitat components for a variety of wildlife. Therefore, no removal of green trees should be allowed within Late-Successional Reserves unless significant human safety hazards (e.g., unstable trees adjacent to campgrounds or trails) are involved.

In many options, more extensive salvage would be allowed where fire, insects, or disease are likely to result in a significant risk to the future development of late-successional and old-growth forests (e.g., Eastern Cascades and Klamath Provinces). The Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992c) provides for a process by which salvage guidelines can be adapted to specific conditions. A similar process should be adopted to provide guidance for management of salvage in Late-Successional Reserves.

In Matrix areas, objectives for post-disturbance management will generally be different from that for Late-Successional Reserves. Economic benefits of timber production will receive greater consideration. For example, the commercial salvage of dead trees will be less constrained, and replanting of disturbed areas will be a high priority. However, because the Matrix provides habitat and connectivity for many organisms, post-disturbance management must achieve a balance between economic and ecosystem objectives. Standards and guidelines for post-disturbance management were generally similar to those for timber harvest management, but restoration planning must consider local conditions and site-specific information.

## (b) Development and Description of Terrestrial Options

### Terrestrial Reserves: Late-Successional Reserves and Managed Late-Successional Areas

Habitat areas -- often referred to as "conservation areas" or, for this report, Late-Successional Reserves -- have been key components of most spotted owl and late-successional forest management strategies developed in the Pacific Northwest in the last decade. Thomas et al. (1990), the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992c), Johnson et al. (1991), and Thomas et al. (1993) all recommended large blocks of federal land that encompass late-successional forests to serve as habitat areas. Although habitat areas from these plans were variously named, the objective of each plan was to provide areas where habitat would occur in amounts and arrangements capable of supporting multiple, reproductive pairs of spotted owls and other species associated with old-growth forests.

We used the conservation areas or Reserves from the above mentioned works to develop options. We briefly describe the biological rationale for, and criteria used to delineate the Reserves and Managed Late-Successional Areas of each of the plans.

## Conservation areas of the Interagency Scientific Committee's Strategy and the Final Draft Recovery Plan for the Northern Spotted Owl

Conservation areas recommended by Thomas et al. (1990) and the Final Draft Recovery Plan (USDI 1992c) were designed to support multiple pairs of northern spotted owls. Empirical data from studies of other bird species and modeling results indicate that habitat patches or areas capable of supporting fewer than 15 breeding pairs have a low probability of successfully supporting the expected numbers of pairs through time. Fluctuations in birth and death rates or stochastic events are more likely to cause populations in such areas to "wink out," causing local extirpations. This information led the Interagency Scientific Committee (Thomas et al. 1990), and later the Northern Spotted Owl Recovery Team (USDI 1992c), to prescribe conservation areas large enough to support at least 20 pairs of spotted owls. Where lack of federal land or limitations in the amount of spotted owl habitat made it impossible to delineate 20-pair conservation areas, smaller areas were prescribed.

Principles of conservation biology and common sense also indicate that conservation areas should be located in a network system so that individuals of the species can successfully move (disperse) among such areas. Successful dispersal is necessary for recolonization of areas where habitat may be temporarily lost and it provides for maintenance of genetic diversity. The conservation areas of Thomas et al. (1990) and the Final Draft Recovery Plan (USDI 1992c) were spaced so as to accommodate dispersal of spotted owls. The conservation areas capable of supporting at least 20 pairs of spotted owls were to be no more than 12 miles apart, and those capable of supporting fewer than 20 pairs were to be no more than 7 miles apart. The 12-mile distance was within the dispersal radius of about two-thirds of the spotted owls observed in studies.

Thomas et al. (1990) and the Final Draft Recovery Plan (USDI 1992c) suggested that the successful movement by spotted owls would be increased if federal lands between the conservation areas (known as the forest Matrix) provided spotted owls with forage areas and cover from predation. To facilitate successful movement, the plans prescribed the 50-11-40 rule. This rule is described in the discussion on standards and guidelines. The 50-11-40 prescription is intended to provide a forested condition in the Matrix sufficient to sustain dispersing owls between conservation areas.

The following criteria were used to delineate the conservation areas:

- Conservation areas are to include 20 known pairs of spotted owls when possible.

- Conservation areas are to be widely distributed throughout the range of the northern spotted owl to provide redundancy in the network.

- Each conservation area is to be within the prescribed dispersal distance of at least two other conservation areas--again to provide redundancy in the network, and to increase the probability of successful movement by owls among the areas.

- Conservation areas are to be as circular as possible because this shape minimizes edge and maximizes interior forest conditions. Forest interior conditions are believed to be important to spotted owl survival. Because ownership patterns and actual terrain within the northern spotted owl range make it impossible to delineate circular conservation areas, the plans conditions are believed to be important to spotted owl survival. Because ownership patterns and actual terrain within the northern spotted owl range make it impossible to delineate circular conservation areas, the plans delineated large blocky conservation areas that mostly tended to be square or rectangular shaped.

- As much as possible, conservation areas are to be identified using wilderness areas and other land allocations where no timber harvest is planned.

- Conservation areas are to be distributed so forests at various elevations and in various ecological zones are included. The plans placed particular emphasis on delineated conservation areas in the lower elevational forest lands, which are generally more biologically productive than forests at higher elevations.

- In the Final Draft Recovery Plan (USDI 1992c), the conservation areas were adjusted to include known locations of other species associated with late-successional forests.

## Reserves from Johnson et al. 1991

The report of the Scientific Panel on Late-Successional Forest Ecosystems (Johnson et al. 1991) identified large geographic areas the panel called "reserves." These Reserves were analogous to our Late-Successional Reserves and were identified primarily on the basis of locations of late-successional forests. Late-successional forests include mature forest stands greater than 80 years old, stands of mixed age (mature and old-growth forests), and old-growth forests.

The areas mapped as Reserves were aggregations of late-successional and old-growth forest stands that were categorized into three groups based on ecological significance. These categories were (1) most significant (LS/OG1), (2) significant (LS/OG2), and (3) remaining late-successional/old-growth forests (LS/OG3). The following characteristics of an area gave it ecological significance:

- Large contiguous blocks of forest that maximize the area of forest with interior forest conditions.

- A location that is key to the design of an interconnected system or network of late-successional conservation areas.

- Presence of classic old-growth forest as defined in Forest Service Research Note PNW-447 (Old-Growth Definition Task Force 1986).

- Areas of late-successional forests on lands with higher site productivity (generally lower elevation) that are believed to have greater biological diversity than late-successional forests at higher elevations.

- Areas with known or likely occurrence of spotted owls, marbled murrelets, or other species associated with late-successional forests.

In addition to the late-successional forest areas (LS/OG), Johnson et al. (1991) identified areas known as "owl additions" that, in combination with the LS/OG1s, would meet the criteria for spotted owl conservation areas from Thomas et al. (1990). The owl additions in combination with the LS/OG1 areas formed Reserves under some alternatives identified by Johnson et al. (1991).

## Conservation Areas from the Scientific Analysis Team Report

Thomas et al. (1993) identified conservation areas beginning with either those of the Interagency Scientific Committee (Thomas et al. 1990) or the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992c). The biological rationale for these areas was described above. Other terrestrial conservation areas that result from the application of mitigation steps offered in Thomas et al. (1993) are:

- Conservation areas resulting from protection of forest stands occupied by rare and locally endemic species closely associated with old-growth forests (at least 17 species).
- Conservation areas resulting from the protection of other species found in the upland forest Matrix (Del Norte salamander and great gray owl).

The small conservation areas that would result from protection of rare and locally endemic species and the Del Norte salamander and great gray owl are needed because significant numbers in such species, within the range of the northern spotted owl, occur outside the other larger conservation areas.

## Recommendations of the Marbled Murrelet Working Team

The current effort incorporates recommendations from a marbled murrelet working team which were used in most options. The marbled murrelet working team assessed the network of Reserves from each of the three plans described above. The working team identified a minimum Late-Successional Reserve network on federal forest land they believed was necessary for an option to have a high probability of providing marbled murrelet nesting habitat in adequate amounts and arrangements to support viable populations. The working team identified two zones based on observed use and expected occupancy by marbled murrelets. Zone 1 extends 10 to 40 miles inland from the marine environments, depending on geographic area. The majority of murrelet occupied sites and sightings occur in this zone. Distances vary by geographic region, as follows:

> Washington - Marine environments to 40 miles inland.
>
> Oregon - Marine environments to 35 miles inland.
>
> California at the Oregon border - Marine environments to 35 miles inland; thence southward maintaining a distance of 35 miles inland to a point of intersection with the Klamath River. The eastern boundary of zone 1 then follows the Klamath River southward to a point where it is 25 miles from the marine environments (near the town of Orleans, California); from that point, zone 1 extends southward with the eastern boundary remaining 25 miles inland until a point near the town of Ukiah, California. From Ukiah the eastern boundary of zone 1 then follows Route 253 to a point where it is 10 miles from marine environments; thence the eastern boundary of zone 1 extends southward, remaining 10 miles inland, to the southern end of the range of the northern spotted owl.

Zone 2 includes areas further inland from the eastern boundary of zone 1, and is characterized by relatively low numbers of murrelet sightings, partially a function of few inventories. Specific distances for zone 2 by geographic area are as follows:

Washington - from the eastern boundary of zone 1 (40 miles inland) to 55 miles inland from marine environments.

Oregon - from the eastern boundary of zone 1 (35 miles inland) to 50 miles inland from marine environments.

California - from the eastern boundary of zone 1 to 45 miles inland from marine environments to a point where the eastern boundary of zone 2 intersects with California Highway 175. At this point the southern boundary of zone 2 follows Highway 175 until it intersects with zone 1, where it ends.

In zone 1, the working team determined that a Late-Successional Reserve network should consist of the most significant late-successional forest areas (LS/OG1s), the significant late-successional forest areas (LS/OG2s), and the owl additions (or equivalent area) from Johnson et al. (1991). In addition to the network of Late-Successional Reserves, the murrelet team recommended surveys (to an accepted protocol) and protection of all sites occupied by murrelets in zones 1 and 2, regardless of whether they were in a Reserve or not. Occupied forest stands are to be protected as follows:

1. The contiguous stand within 0.5 mile of the occupied site will be protected from cutting.

2. Forest stands within 0.5 mile of the occupied site that are currently not suitable as nesting habitat, but will likely develop into such habitat within 25 years (100 years old) and are contiguous to the occupied forest stand, will be protected from cutting.

Protection of forest stands occupied by marbled murrelets in both zones 1 and 2 creates additional small Late-Successional Reserves including younger forests that will grow and develop into suitable nesting habitat for marbled murrelets.

## Standards and Guidelines for Vegetation Management

In addition to standards and guidelines we developed for this report, we used other standards and guidelines derived from earlier plans proposed for the management of federal forest lands. Brief descriptions of four sets of standards and guidelines for vegetation management that we used follow:

The first set, standards and guidelines from the Scientific Panel on Late-Successional Forest Ecosystems (Johnson et al. 1991), provided for management of the late-successional/old-growth forest areas (LS/OG), called "reserves" in that report, and for areas between the reserves, or the forest Matrix. Standards and guidelines for the Reserve restricted the cutting of trees to precommercial silvicultural treatments of young stands. Timber sales that had already been awarded were exempted from this prohibition.

Johnson et al. (1991) also proposed options for the management of the forest Matrix. In this report, the Forest Ecosystem Management Assessment Team used two of the Matrix options from Johnson et al. (1991):

- Forest Matrix Management Option A -- This option was designed to augment the standards and guidelines that were in effect under forest plans of the federal agencies. The 50-11-40 rule developed by Thomas et al. (1990) was included with an additional provision to increase the retention of old-growth structural components left after logging to provide structure in the forested environments. The 50-11-40 rule called for at least 50 percent of the forest stands on federal lands in a quarter-township to be at least 11 inches in diameter at breast height and for such stands to have a canopy closure of at least 40 percent. The intent of the 50-11-40 rule was to provide for conditions that would facilitate successful movement of spotted owls among reserves. The prescription for retention of old-growth forest structural components consisted of leaving six large green trees, two large snags (standing dead trees), and two large logs per acre after logging.

- Forest Matrix Management Option C -- This option is identical to option A but further stipulates that at least 10 percent of the forest outside Wilderness Areas and the proposed Reserves was to be older than 180 years. The remaining forest stands in the Matrix were to be managed using an area-control timber harvest strategy to achieve 180-year timber harvest rotations. At most, 1/18th of the area remaining in the Matrix would be cut per decade.

Standards and guidelines proposed by Johnson et al. (1991: 26) for the protection of watersheds and fish habitat include: (1) 180-year timber harvest rotations in "Key Watersheds" identified for their high water quality and the presence of species and stocks of fish considered to be at risk, and (2) riparian buffer zones. Riparian buffers of varying width were prescribed depending on the type of stream or wetland. There was to be no cutting of timber in the buffers and livestock grazing was to be curtailed to promote the reestablishment of riparian vegetation. A road improvement and reduction program was also to be implemented.

A second set of standards and guidelines we used was contained in the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992c). This plan provided direction for the management of vegetation in the recommended conservation areas and the intervening federal forest lands -- the Matrix. Several categories of conservation areas were proposed, with variations in the standards and guidelines for each type. Descriptions of the standards and guidelines follow:

- Designated conservation areas -- Standards and guidelines for these areas have several key objectives (USDI 1992c: 64-75). They allow natural successional processes to continue in areas currently suitable as spotted owl habitat, and they focus silvicultural activities on developing suitable habitat for spotted owls in areas that are currently unsuitable. Salvage of dead trees is allowed where it will not retard development of suitable habitat. Standards and guidelines also provide for treatment of some forest stands within some of the conservation areas to reduce risk of large-scale disturbances. In some situations, these may include stands that are currently suitable owl habitat. The Recovery Plan indicates that a management plan for each designated conservation area should be completed prior to implementation of silvicultural activity in that conservation area.

- Reserved pair areas -- Standards and guidelines for management of vegetation within this category of conservation area are the same as those for the designated conservation areas (USDI 1992c: 86).

- Managed pair areas -- In this category of conservation area, the objective of the standards and guidelines is to always maintain an acreage of suitable habitat equal to the median amount observed in home ranges of pairs of spotted owls in each physiographic province (USDI 1992c: 86). A wider application of silvicultural activities designed to reduce the risk of large-scale disturbances is permitted in managed pair areas.

- Residual habitat areas - These conservation areas incorporate 100 acres of suitable spotted owl habitat as close as possible to the nest site or activity center of a pair of spotted owls or a single, territorial spotted owl. Timber management is not appropriate in the residual habitat areas, and adjacent management should be designed to reduce risk of natural disturbance.

- Matrix management -- The Draft Final Recovery Plan for spotted owls prescribed the 50-11-40 rule as a standard and guideline for management of vegetation outside the conservation areas.

The third set we drew from, the report of the Scientific Analysis Team (Thomas et al. 1993), provided standards and guidelines associated with several major components of a strategy that was developed to provide for species associated with old-growth forests within the range of the northern spotted owl using a step-wise approach. The standards and guidelines used within this report follow:

- Standards and guidelines for riparian habitat conservation areas (Thomas et al. 1993: 447-458) include the establishment of interim riparian buffers of varying widths for different categories of streams, lakes, and wetlands. Buffers for riparian areas vary from a minimum of 300 feet (on each side of the stream) for fish-bearing streams and lakes, to a minimum of 150 feet on each side of perennial streams without fish, and around ponds, reservoirs, and wetlands greater than 1 acre, to at least 100 feet on seasonally flowing streams or wetlands less than 1 acre. The riparian buffers are interim until watershed analyses are completed that may reduce or increase the widths of the buffers in some areas (see chapter V, Aquatic Ecosystem Assessment, for a description of watershed analysis). Vegetation management in the buffers would be limited to removal of hazard trees, silvicultural activities that create conditions needed to attain riparian objectives, and some limited salvage of dead trees following large catastrophic events. "Key Watersheds" identified by Thomas et al. (1993: 449) are delineated using the same criteria as those used by Johnson et al. (1991). However, under the standards and guidelines of the Scientific Analysis Team, Key Watersheds are used to establish priority areas for completing watershed analyses and restoration work rather than as areas where there would be extended timber harvest rotation as under Johnson et al. (1991).

- Standards and guidelines for protection of rare and locally endemic species (Thomas et al. 1993: 291-295) include inventories in areas where activities are planned that could disturb or destroy habitat occupied by such species. Sites occupied by rare and locally endemic species would be protected when located.

- Standards and guidelines for the protection of habitat for other species in the upland Matrix (Thomas et al. 1993: 295-299) consist of (1) conducting surveys and protecting sites occupied by Del Norte salamanders; (2) retaining a greater numbers of snags and green trees within the range of the white-headed woodpecker, black-backed woodpecker, pygmy nuthatch,

> and flammulated owl; (3) providing buffers around meadows and natural openings within the range of the great gray owl; (4) completing the habitat capability model for fisher and American marten by the National Forests in California and retaining all management requirement areas for martens on National Forests and in Oregon and Washington; (5) regulatory closure of kill trapping of martens in Oregon and Washington where the range of the American marten overlaps with that of the fisher (to avoid accidental kill trapping of fishers); (6) developing site-specific timber harvest, roading, and fire management plans in the range of the lynx to improve conditions for lynx.

The Forest Ecosystem Management Assessment Team developed additional standards and guidelines for some options. The bases for these standards and guidelines are presented in the section on Ecological Principles for Management of Late-Successional Forests.

# 3. ADAPTIVE MANAGEMENT AREAS - *FROM FEMAT REPORT.*

*Applicable to Alternative 9 only, the following section of the FEMAT Report describes the overall objectives for Adaptive Management Areas, as well as more specific objectives for each particular area. Because a primary objective of these areas is innovation, more specific standards and guidelines for management are not provided.*

## Adaptive Management Areas

Adaptive Management Areas are landscape units designated to encourage the development and testing of technical and social approaches to achieving desired ecological, economic, and other social objectives. Ten areas containing a range from about 84,000 to nearly 400,000 acres of federal lands have been identified. The areas are well distributed in the physiographic provinces. Most are associated with subregions impacted socially and economically by reduced timber harvest from the federal lands. The areas provide a diversity of biological challenges, intermixed land ownerships, natural resource objectives, and social contexts. In the Applegate Adaptive Management Area in Oregon, community-based activities have already begun from the grassroots.

The Adaptive Management Areas are specifically designated in Option 9, but the concept could be applied within any of the options. Specific boundaries of the areas would have to be modified consistent with particular options, and biological, economic, and social assessments would have to be revised to be consistent with those allocations.

The overarching objective for Adaptive Management Areas is to learn how to do ecosystem management in terms of both technical and social challenges, and in a manner consistent with applicable laws. It is hoped that localized, idiosyncratic approaches that may achieve the conservation objectives of this plan can be pursued. These approaches rely on the experience and ingenuity of resource managers and communities rather than traditionally derived and tightly prescriptive approaches that are generally applied in management of forests.

The Adaptive Management Areas are intended to contribute substantially to the achievement of objectives for Option 9. This includes provision of well-distributed late-successional habitat outside of reserves, retention of key structural elements of late-successional forests on lands subjected to regeneration harvest, and restoration and protection of riparian zones as well as provision of a stable timber supply.

The Adaptive Management Area concept incorporates the three adaptive management models/objectives discussed elsewhere in this report--technical, administrative, and cultural/social.

Key features of the Adaptive Management Areas:

- The areas are well-distributed geographically and represent a mix of technical and social challenges and are of sufficient size to provide for landscape-level management approaches.
- The areas provide for development and demonstration of monitoring protocols and new approaches to land management that integrate economic and ecological objectives based upon credible development programs and watershed and landscape analysis.
- Opportunities exist for education, including technical training to qualify local community residents for employment in monitoring and other management programs.
- Innovation in community involvement is encouraged, including approaches to implementation of initial management strategies and perhaps, over the longer term, development of new forest policies.
- Innovation is expected in developing adequate and stable funding sources for monitoring, research, retraining, restoration and other activities.
- Local processing (county level) of forest products harvested from the Adaptive Management Areas are encouraged.
- Innovation in integration of multi-ownership watersheds is to be encouraged between federal agencies and is likewise encouraged between state and federal agencies, and private landowners.
- Innovation in agency organization and personnel policies includes tests and modification in recruitment and promotion procedures to encourage local longevity among the federal workforce.

## Selection of the Adaptive Management Areas

Adaptive Management Areas were selected to provide opportunities for innovation, to provide examples in major physiographic provinces, and to provide a range of technical challenges, from an emphasis on restoration of late-successional forest conditions and riparian zones to integration of commercial timber harvest with ecological objectives.

The Adaptive Management Areas have been geographically located to minimize risk to the overall conservation strategy. The Adaptive Management Areas were intended to provide a mixture of public and private ownerships. In locating the Adaptive Management Areas, the proximity of communities that were subject to adverse economic impact resulting from reduced federal timber harvest was considered. The social and economic analysis of the Forest Ecosystem Management Assessment Team (reported elsewhere in this report) was a major source of information that helped guide these decisions.

The Adaptive Management Areas also provide a mixture of ownerships. Six areas include lands administered by the Forest Service and Bureau of Land Management. In two areas (Northern Oregon Coast Ranges and Olympic) there are significant opportunities for the states to participate in a major cooperative adaptive management effort with their forest lands. The majority of areas also have interspersed privately owned forest lands that could be incorporated into an overall plan if landowners so desired.

Establishment of the Adaptive Management Areas is not intended to discourage the development of innovative social and technical approaches to forest resource issues in other locales. These are intended to provide a geographic focus for innovation and experimentation with the intent that such experience will be widely shared. The array of areas provide a balance between having a system of areas that is: (1) so large and diffuse that it lacks focus and adequate resources and has extensive management constraints because of its size and overall impact on regional conservation strategies; and (2) too small to allow for meaningful ecological and social experimentation.

## Technical Objectives

The Adaptive Management Areas have scientific and technical innovation and experimentation as objectives. These are difficult to achieve under traditional agency management. The guiding principle is to allow freedom in forest management approaches to encourage innovation in achieving the goals of Option 9. This challenge includes active involvement by the land management and regulatory agencies early in the planning process.

The primary technical objectives of the Adaptive Management Areas are development, demonstration, implementation, and evaluation of monitoring programs and innovative management practices that integrate ecological and economic values. Experiments, including some at quite large-scale, are likely. Demonstrations and pilot projects, while perhaps significant, useful, and encouraged in some circumstances, may not be sufficient to achieve the objectives in and of themselves.

Monitoring is essential to the success of any selected option and to an adaptive management program. Currently, adequate monitoring is essentially nonexistent throughout the federal resource management agencies despite being required by forest plans. Hence, development and demonstration of monitoring and training of the workforce are technical challenges and are suggested for emphasis.

Technical topics requiring demonstration or investigation are a priority for Adaptive Management Areas and cover a wide spectrum, from the welfare of organisms to ecosystems to landscapes. Included are development, demonstration, and testing of techniques for:

- Creation and maintenance of a variety of forest structural conditions including late-successional forest conditions and desired riparian habitat conditions.

- Integration of timber production with maintenance or restoration of fisheries habitat and water quality.

- Restoration of structural complexity and biological diversity in forests and streams that have been degraded by past management activities and natural events.

- Integration of wildlife welfare (particularly of sensitive and threatened species) with timber management.

- Development of logging and transportation systems with low impact on soil stability and water quality.

- Design and testing of effects of forest management activities at the landscape level.

- Restoration and maintenance of forest health using controlled fire and silvicultural approaches.

Each Adaptive Management Area should have an interdisciplinary technical advisory panel, including specialists from outside government agencies, that would provide advice on research, development, and demonstration programs.

## Social Objectives

The primary social objective of Adaptive Management Areas is the provision of flexible experimentation with policies and management. These areas should provide opportunities for land managing and regulatory agencies, other government entities, nongovernmental organizations, local groups, land owners, communities, and citizens to work together to develop innovative management approaches. Broadly, Adaptive Management Areas are intended to be prototypes of how forest communities might be sustained.

Innovative approaches include social learning and adaptation, which depend upon local communities having sufficient political capacity, economic resources, and technical expertise to be full participants in ecosystem management. Similarly, management will need to be coordinated with collaboration across political jurisdictions and diverse ownerships. This will require mediating across interests and disciplines, strengthening local political capability, and enhancing access to technical expertise. Adaptive management is, by definition, information dependent. Setting objectives, developing management guidelines, educating and training a workforce, organizing interactive planning and management institutions, and monitoring accomplishments all require reliable, current inventories. New information technologies can be used to provide such information. But a well-trained workforce to collect and assimilate required information is largely lacking. Local persons might be ideally suited to this task if appropriately trained.

## Agency Approaches and Management Oversight

Federal agencies are expected to use Adaptive Management Areas to explore alternative ways of doing business internally, with each other, and with other organizations, local and state government, and private landowners. In effect, the areas should be used to "learn to manage" as well as "manage to learn."

Agencies are expected to develop plans (jointly, where multiple agencies are involved) for the Adaptive Management Areas. Development of a broad plan that identifies general objectives and roles, and provides flexibility should be the goal. Such a plan could be used in competing for financial resources, garnering political support, providing a shared vision, and keeping track of experience.

If the Adaptive Management Areas are to make timely contributions to the regional conservation strategy and to the communities, it is absolutely critical that initiation of activities not be delayed by requirements for comprehensive plans or consensus documents beyond those required to meet existing legal requirements. Development of such documents can proceed simultaneously with other activities;

the only area in which detailed planning must precede any activities is the Snoqualmie Pass Adaptive Management Area. Forest plans, as modified by the directions laid down in the selected conservation strategy, can provide the starting point for activities. Initial involvement of user groups and communities would emphasize how the strategy and plans should be implemented.

Initial direction and continuing oversight should be provided by a regional interagency group, possibly working through the Provincial Interagency Team if this concept is adopted from the implementation plan. It is important that the interagency coordination involve both the regulatory and management agencies and that the regulatory agencies participate in planning and regular review processes.

## Funding the Adaptive Management Area Program

To achieve its multiple objectives the Adaptive Management Area program will require substantial and stable funding sources. Regular appropriations are one obvious source but are likely to be insufficient in amount and predictability to meet programmatic needs. Hence, developing innovative approaches to financing is an essential element of the Adaptive Management Area strategy.

Possible funding mechanisms for programs associated with Adaptive Management Areas include:

1. Using all or portions of the receipts from Adaptive Management Areas for accelerated monitoring, research, retraining, restoration and other innovative activities within these areas.

2. Authorizing agencies to assess user fees that could be retained for use within Adaptive Management Areas.

3. Using objective-based "end result" budgeting approaches with agency budgets.

4. Agency authorization for experimentation with nontraditional approaches to resource valuation, including market-based approaches to noncommodity resources, the purchasing, selling, and trading resources (e.g., private purchase of commercial timber for retention, rather than harvest).

5. Provision for other kinds of cooperative funding arrangements with other land owners, governmental bodies, organizations, and private individuals. In addition to funds needed for programs on the Adaptive Management Areas there may also be a need for risk capital for community-based efforts and pilot programs in incentive-based management agreements with private landowners.

If receipts are used as a source of funding for programs in Adaptive Management Areas several factors need to be considered. First, development of a common pool should be considered because all areas have the same basic needs -- such as in monitoring and retraining -- but differ greatly in their ability to generate revenues. Second, some portion of the funds should probably be reinvested on the same area, but care should be taken to avoid developing a negative feedback whereby resource exploitation is being stimulated by a desire for additional funds.

Development of additional innovative funding sources must not be viewed as a substitute for appropriate funds for management and research. Rapid implementation of programs within Adaptive Management Areas is essential to both their regional function and to the adjacent communities. In at least the short term, this implementation will only be possible through the regular appropriation process. Indeed, the intensity of activity proposed on the Adaptive Management Areas calls for higher levels of appropriated funds in the short term rather than lower levels.

## Timber Supply

One reason for locating Adaptive Management Areas adjacent to adversely economically impacted communities is to provide opportunity for social and economic benefits to these areas. Adaptive Management Areas are expected to produce timber as part of their program of activities consistent with their specific direction under Option 9. The rates and methods of harvest will be determined on an area-by-area basis. Each area management team is expected to develop a strategy for ecosystem management to guide implementation, restoration, monitoring, and experimental activities involving timber sales. The strategy should contain a short-term (3 to 5 year) timber sale component and a long-term projection of timber yield.

Local processing of wood products harvested from federal lands within Adaptive Management Areas may be critical to the economic welfare of the associated communities as well as essential to creation of adaptive management approaches. If local processing is not achieved, the potential economic benefits to the local communities may not be realized. Hence, agencies are encouraged to develop approaches which encourage or require processing of a portion of the harvest within the local area, defined here as the county or counties within which the Adaptive Management Area is located. Sufficient legal authorities may already exist in laws such as the Cooperative Sustained Yield Act and the National Forest Dependent Rural Communities Economic Diversity Act (part of the 1990 Farm Bill).

## Education

Each Adaptive Management Area was located adjacent to one or more communities with economies and culture long associated with utilization of forest resources. As a result, the people have a sense of place and desire for involvement. Many of these local workers already possess the woods skills and knowledge and sense of place that make them natural participants in ecosystem-based management and monitoring. Here adaptive management can bring indigenous knowledge together with formal studies, the local communities and the land management agencies in a mix that may provide creative common-sense approaches to complicated problems.

Technical and scientific training of a local workforce should be an educational priority of the Adaptive Management Area program. A program of formal schooling and field apprenticeship might provide the workforce needed to help implement ecosystem management, particularly in the area of monitoring. This program might be based on collaborations among local community colleges, state universities, and the agencies.

# Descriptions of the Adaptive Management Areas

Adaptive Management Areas are shown on the appendix map for Option 9. Late-Successional Reserves provide for a major element of the Option 9 conservation strategy. Adaptive Management Areas would contribute to accomplishing the objectives of the option, such as protection or enhancement of riparian habitat and provision for distributed late-successional forest habitat. Detailed prescriptions for achieving such objectives are not provided, however, so that managers may develop and test alternative approaches, applicable to their areas and in a manner consistent with existing environmental and other laws.

Riparian protection in Adaptive Management Areas should be comparable to that prescribed for other federal land areas. For example, Key Watersheds with aquatic conservation emphasis within Adaptive Management Areas must have a full watershed analysis and initial buffers comparable to those for Tier 1 Key Watersheds. Riparian objectives (in terms of ecological functions) in other portions of Adaptive Management Areas should have expectations comparable to Tier 2 Key Watersheds. However, flexibility is provided to achieve these conditions, if desired, in a manner different from that prescribed for other areas and to conduct bonafide research projects within riparian zones.

Guidelines for sustaining marbled murrelet habitat necessitates management restrictions for Adaptive Management Areas within the primary murrelet zone if Option 9 is to rate at least an 80 percent likelihood of providing nesting habitat well-distributed in the planning area at 100 years (see Chapters IV and V). In the two Adaptive Management Areas where most late-successional forests have already been harvested (Northern Oregon Coast Ranges and Finney), required mitigation is: (1) survey for and protection of all occupied murrelet sites (see Option 1); (2) retention of LS/OG1s, LS/OG2s, and owl additions (from Johnson et al. 1991) as Late-Successional Reserves within the Adaptive Management Areas. These reserves should be managed as stipulated for such reserves under Option 9. On the Olympic Peninsula, where larger reserves of late-successional forests remain on federal lands, all sites occupied by marbled murrelets will be protected (see Option 1). In all the Adaptive Management Areas, management activities will be conducted to achieve the objectives described for Option 9. Full watershed assessments will be conducted prior to new management activities in identified Key Watersheds with Adaptive Management Areas.

| **Name:** | **Applegate Adaptive Management Area, Oregon** |
|---|---|
| Size: | 268,600 acres. |
| Ownership: | Medford District, Bureau of Land Management; Rogue River and Siskiyou National Forests; potentially state and private lands. |
| Associated communities: | Grants Pass and Medford, Oregon; Jackson and Josephine Counties, Oregon; and Siskiyou County, California. |
| Emphasis: | Development and testing of forest management practices, including partial cutting, prescribed burning, and low impact approaches to forest harvest (e.g., aerial systems) that provide for a broad range of forest values, including late-successional forest and high quality riparian habitat. Late-Successional Reserves are included in the Adaptive Management Area boundaries. |

**Name:** **Blue River Adaptive Management Area, Oregon**

Size: 153,200 acres.
Ownership: Willamette National Forest; Eugene District Bureau of Land Management; potentially state and private lands.
Associated Communities: Eugene, Springfield, and Sweet Home, Oregon.
Emphasis: Intensive research on ecosystem and landscape processes and its application to forest management in experiments and demonstrations at the stand and watershed level; approaches for integrating forest and stream management objectives and on implications of natural disturbance regimes; and management of young and mature stands to accelerate development of late-succession conditions, a specific management objective for the forests within the Moose Lake block as well as in other portions of the Adaptive Management Area to be selected. Current status of the H. J. Andrews Experimental Forest as an Experimental Forest, i.e., maintenance of control areas and full flexibility to conduct experiments is retained. One Late-Successional Reserve is included in the area.

**Name:** **Cispus Adaptive Management Area, Washington**

Size: 142,900 acres.
Ownership: Gifford Pinchot National Forest; potentially state and private lands.
Associated Communities: Randle, Morton, and Packwood, Washington; Lewis and Skamania Counties, Washington.
Emphasis: Development and testing of innovative approaches at stand, landscape, and watershed level to integration of timber production with maintenance of late-successional forests, healthy riparian zones, and high quality recreational values.

**Name:** **Finney Adaptive Management Area, Washington**

Size: 101,100 acres.
Ownership: Mt. Baker-Snoqualmie National Forest; potentially state and private lands.
Associated Communities: Darrington, Washington; Skagit and Snohomish Counties, Washington.
Emphasis: Restoration of late-successional and riparian habitat components and provision of stable timber supply. Retention of habitat consistent with guidelines for marbled murrelet areas as noted at the beginning of this section. Sites occupied by spotted owls (pairs or territorial singles) will be protected by establishing Late-Successional Reserves using procedures to delineate Reserved Pair Areas under the Final Draft Recovery Plan for Northern Spotted Owls (USDI 1992c).

| | |
|---|---|
| **Name:** | **Goosenest Adaptive Management Area, California** |
| Size: | 169,600 acres. |
| Ownership: | Klamath National Forest; potentially private lands. |
| Associated Communities: | Yreka, Montague, Dorris, Hornibrook; Siskiyou County, California. |
| Emphasis: | Development of ecosystem management approaches, including use of prescribed burning and other silvicultural techniques, for management of pine forests, including objectives related to forest health, production and maintenance of late-successional forest and riparian habitat, and commercial timber production. |

| | |
|---|---|
| **Name:** | **Hayfork Adaptive Management Area, California** |
| Size: | 399,500 acres. |
| Ownership: | Shasta-Trinity and Six Rivers National Forests and Yreka District Bureau of Land Management; potentially private and state lands. |
| Associated Communities: | Hayfork, California; Trinity and Humboldt Counties, California. |
| Emphasis: | Development, testing, and application of forest management practices, including partial cutting, prescribed burning, and low-impact approaches to forest harvest, which provide for a broad range of forest values, including commercial timber production and provision of late-successional and high quality riparian habitat. Maintain identified Late-Successional Reserves; conduct full watershed analysis in critical watersheds. |

| | |
|---|---|
| **Name:** | **Little River Adaptive Management Area, Oregon** |
| Size: | 83,900 acres. |
| Ownership: | Umpqua National Forest and Roseburg District Bureau of Land Management; potentially private and state lands. |
| Associated Communities: | Roseburg, Myrtle Creek, Oregon; Douglas County, Oregon. |
| Emphasis: | Development and testing approaches to integration of intensive timber production with restoration and maintenance of high quality riparian habitat. |

| | |
|---|---|
| **Name:** | **Northern Coast Range Adaptive Management Area, Oregon** |
| Size: | 247,000 acres. |
| Ownership: | Siuslaw National Forest and Salem District Bureau of Land Management; with potential participation by the Oregon Department of Forestry and private landowners. |
| Associated Communities: | Tillamook, Willamina, Grand Ronde, Oregon; Polk, Yamhill, Tillamook, and Washington Counties, Oregon. |

Concept: Management for restoration and maintenance of late-successional forest habitat, consistent with marbled murrelet guidelines noted at the beginning of this section. Conduct watershed analysis of the Nestucca River drainage. Subsequently, the Oregon Department of Forestry will be invited to collaborate in development of a comprehensive strategy for conservation of the fisheries and other elements of biological diversity in the northern Oregon Coast Ranges. All occupied marbled murrelet (see Option 1) and northern spotted owl sites will be protected by establishing Reserved Pair Areas under the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992c).

**Name: Olympic Adaptive Management Area, Washington**

Size: 145,000 acres.

Ownership: Olympic National Forest and potentially Washington Department of Natural Resources, Indian Reservations, and private lands; Jefferson, Clallam, Grays Harbor, and Mason Counties, Washington.

Emphasis: Create a partnership with the Olympic State Experimental Forest established by Washington Department of Natural Resources. Develop and test innovative approaches at the stand and landscape level for integration of ecological and economic objectives, including restoration of structural complexity to simplified forests and streams and development of more diverse managed forests through appropriate silvicultural approaches such as long rotations and partial retention. All occupied marbled murrelet sites will be surveyed for and protected (see Option 1).

**Name: Snoqualmie Pass Adaptive Management Area, Washington**

Size: 261,300 acres

Ownership: Wenatchee and Mt. Baker-Snoqualmie National Forests; Plum Creek Timber Company and other private land owners; state.

Associated Communities: Cle Elum and Roslyn, Washington; Kittitas and King Counties, Washington.

Emphasis: Development and implementation, with the participation of the U.S. Fish and Wildlife Service, of a scientifically credible, comprehensive plan for providing late-successional forest on the "checkerboard" lands. This plan should recognize the area as a critical connective link in north-south movement of organisms in the Cascade Range.

# 4. PROTECTION BUFFERS - *ADDITIONAL STANDARDS AND GUIDELINES FOR OTHER SPECIES IN THE UPLAND FOREST MATRIX, FROM THE SCIENTIFIC ANALYSIS TEAM REPORT (THOMAS ET AL. 1993).*

*The Forest Service's Scientific Analysis Team examined the effects of Forest Plans and the Interagency Scientific Committee (ISC) Conservation Strategy on the viability of species other than northern spotted owl associated with late-successional forests on lands administered by the Forest Service. The Scientific Analysis Team found that these plans did not ensure the viability of all such species and proposed a series of mitigation steps to be applied to Forest Plans. Those mitigation recommendations were reexamined by the Forest Ecosystem Management Assessment Team and incorporated, as appropriate, into the action alternatives. One of the mitigation measures recommended by the Scientific Analysis Team provided specific standard and guideline recommendations for nine species at risk, to be applied wherever the species occurred outside of designated areas. The Assessment Team applied these, as written by the Scientific Analysis Team, to most of the action alternatives. These recommendations, from Thomas et al. (1993) pages 295-299, are as follows:*

(1) Amphibians:

Del Norte Salamander - This species occurs in talus slopes protected by overstory canopy that maintains cool, moist conditions on the ground. The species is a slope-valley inhabitant, and sometimes occurs in high numbers near riparian areas. Riparian habitat Conservation Areas, in combination with habitat Conservation Areas and other reserves, will offer some protection to the species but significant numbers also occur in upland areas. Additional mitigation options in this upland matrix include identifying locations (talus areas inhabited by the species) by using a standardized survey protocol, then protecting the location from ground-disturbing activities. Designate a buffer of at least the height of one site-potential tree or 100 feet horizontal distance, whichever is greater, surrounding the location. Within the site and its surrounding buffer, maintain 40 percent canopy closure and avoid any activities that would directly disrupt the surface talus layer. Partial harvest within the buffer may be possible if 40 percent canopy closure can be maintained; in such cases, tree harvest must be conducted using helicopters or high lead cable systems to avoid compaction or other disturbance of talus.

(2) Birds:

(a) White-headed Woodpecker, Black-backed Woodpecker, Pygmy Nuthatch, and Flammulated Owl - These species will not be sufficiently aided by application of mitigation measures for riparian habitat protection or for marbled murrelets alone. They all occur on the periphery of the range of the northern spotted owl on the east slope of the Cascade Range in Washington or Oregon. Additionally, white-headed woodpecker and flammulated owl occur in the Klamath province in northwestern California and southwester Oregon. The viability of all four species within the range on the northern spotted owl was rated as a medium risk on national Forests, although they each are much more widely distributed elsewhere.

Apply the following mitigation guidelines to ensure that the distribution and numbers of all four species do not severely decline on national Forests with the range of the northern spotted owl. These guidelines apply to the forest matrix outside designated habitat for the norther spotted owl and Riparian Habitat Conservation Areas. Maintain adequate numbers of large snags and green tree replacements for future snags within the four species' ranges in appropriate forest types. Where feasible , green tree replacements for future snags can be left in groups to reduce blowdown. Specifically, we recommend that no snags over 20 inches dbh be marked for cutting. We recognize, however, that safety considerations may prevent always retaining all snags. Use of standardized definitions of hazard trees is required. For the longer term, provide for sufficient numbers of green trees to provide for the full (100 percent) population potential of each species.

As depicted by Neitro et al. (1985), the 100 percent population potential for white-headed woodpeckers is 0.60 conifer snags (ponderosa pine of Douglas-fir) per acre in forest habitats; these snags must be at least 15 inches dbh (or largest available if 15 inch dbh snags are not available) and in soft decay stages (see Neitro et al. 1985 for specifics), and must be provided in stands of ponderosa pine and mixed pine-Douglas-fir. The 100 percent population potential for black-backed woodpeckers is 0.12 conifer snags per acre in forest habitats; these snags must be at least 17 inches dbh (or largest available if 17 inch dbh snags are not available) and in hard decay stages, and must be provided in stands of mixed conifer and lodgepole pine in higher elevations of the Cascade Range. Provision of snags for other cavity-nesting species, including primary cavity-nester, must be added to the requirements for these two woodpecker species. Site-specific analyses, and application of a snag recruitment model (specifically, the forest Service's Snag Recruitment Simulator) taking into account tree species, diameters, falling rates, and decay rates, will be required to determine appropriate tree and snag species mixes and densities. If snag requirements cannot be met, then harvest must not take place.

As identified by the expert panel, black-backed woodpeckers also require beetle infested trees for foraging; some such trees should be provided in appropriated habitat, and sanitation harvest of all such trees would be detrimental to the species. More information is needed on habitat use, seasonal occurrence, and use of forest age classes and burns, for the black-backed woodpecker./

Pygmy nuthatches use habitat very similar to those of white-headed woodpecker. Pygmy nuthatches require large trees, typically ponderosa pine within the range of the northern spotted owl, for roosting. Provision of snags for white-headed woodpeckers is assumed to provide for the needs of pygmy nuthatch, as no species-specific guidelines for the species have been developed. Additional information on ecology of pygmy nuthatch within the range of the northern spotted owl is needed to develop more precise guidelines.

Flammulated owls are secondary cavity-nesters and use cavities, in snags and live trees, created by woodpeckers or, less often, that occur naturally. We assume that standards and guidelines for snags and green tree replacements for woodpeckers and other primary cavity-nesting species, as provided by existing national Forest land and Resource management plans and for the woodpeckers in this species group, would provide for flammulated owls.

(b) Great Gray owl - Within the range of the northern spotted owl, the great gray owl is most common in lodgepole pine forests adjacent to meadows. However, it is also found in other coniferous forest types. In some location, such as on the Willamette national Forest west of the Cascades Crest, at least some shelterwood harvesting seems to be beneficial for the species by opening up otherwise closed canopy cover for foraging. In doing so, consequences to species such as northern goshawk and American marten must be evaluated. Specific mitigation measures for great gray owl, within the range of the northern spotted owl, include the following: provide a no-harvest buffer of 300 feet around meadows and natural openings and establish 1/4-mile protection zones around known nest sites. Within one year, develop and implement a standardized protocol for surveys; survey for next locations using the protocol. Protect all future discovered nest sites as previously described.

(3) Mammals:

(a) American Marten and Fisher - The level of habitat conservation provided by the combination of Alternative B [Forest Plans plus ISC Conservation Strategy] of the Final Environmental Impact Statement, Riparian Habitat Conservation Areas, and marbled murrelet mitigation guidelines are generally sufficient so that additional standards and guidelines are not required to prevent the extirpation of American martens and fishers within the range of the northern spotted owl. However, we do recommend two additional actions for specific areas to help ensure future viability of these species.

First, the National Forests in California must finalize and implement their draft habitat capability model for fisher and American Marten. Implementation of this model would likely reduce information that will further reduce [produce] information that will further reduce risks to viability in those National forests. Forests in

Oregon and Washington must retain existing management requirement areas for American marten for the same reason. However, adequacy of these practices must be reevaluated through the ongoing conservation assessment process or through special review. Monitoring and adaptive management are especially important for these species.

Second, population of fishers are extremely low in northern Oregon and Washington. Harvest of American martens is permitted in these states, and accidental take of fishers cannot be avoided using kill-trap methods. To reduce risk of further loss of fishers, we recommend closure of all national Forests (within the overlapping ranges of American marten, fisher, and northern spotted owls) to kill-trapping of American martens until the rate of accidental take of fishers is determined to be insignificant. We recommend formation of an interagency group comprised of state furbearer biologists and Forest Service wildlife biologists to undertake this evaluation for both states.

(b) Lynx - Lynx are rate within the range of the northern spotted owl, occurring primarily in the Okanogan area of Washington. The lynx is currently listed by the Fish and Wildlife Service as a Category 2 candidate (a species for which additional information is needed to propose listing as threatened or endangered). A petition was filed to list the lynx as endangered within the northern Cascades of Washington, based on small population size, population isolation, and lack of adequate prey base (showshoe hare). However, the fish and wildlife Service ruled that available information does not warrant listing the lynx in Washington (USDI 1992b).

Three primary habitat components for lynx are (1) foraging habitat (15-35 year old lodgepole pine) to support snowshoe hare and provide hunting cover, (2) denning sites (patches of >200-year old spruce and fir, generally <5 acres), and (3) dispersal/travel cover (variable in vegetation composition and structure). The major limiting factor is abundance of snowshoe hare, which in turn is limited by availability of winter habitat (primarily early-successional lodgepole pine with trees at least 6 feet tall). Past excessive trapping of lynx and incidental mortality of lynx from hunting of other species have depressed populations and may have been detrimental to local lynx populations in Washington (Washington Department of Wildlife 1991). Roads provide access to hunters and trappers and thus road density may be related to lynx mortality.

Alternative B as described in the Final Environmental Impact Statement, as well as existing high elevation reserves, will provide denning habitat within protected forest stands in juxtaposition with early successional vegetation in the forest matrix. Connectivity between many of the denning patches will be provided by the network of buffers along streams under the Riparian habitat Conservation Areas.

In addition, we propose development of site-specific timber harvest, roading, and fire management plans in known lynx range. These plans should be developed in consultation with state wildlife agencies and should address: (1) minimizing road construction, closing unused roads, and maintaining roads to the minimum standard possible; (2) using prescribed fire to maintain forage for snowshoe hare in juxtaposition with hunting cover; (3) designating areas as closed to kill trapping of any furbearer to avoid incidental lynx mortality to maintain population refugia for lynx in key areas; (4) planning for kill trapping closure on a wider basis if data indicate a declining lynx population as a result of incidental trapping mortality; and (5) developing and implementing a credible survey and monitoring strategy to determine the distribution of lynx throughout its potential range. (pages 295-299).

# 5. RECOVERY PLAN STANDARDS AND GUIDELINES

*These guidelines are adapted from the* Final Draft of the Northern Spotted Owl Recovery Plan (USDI 1992a). *Some or all of these guidelines are applied in Options 2 through 10. See the individual option descriptions for specific application of the guidelines.*

## Guidelines for Silvicultural Activities and Salvage in Late-Successional Reserves

### Guidelines for silviculture

The primary objective of silvicultural activities in Late-Successional Reserves is to improve habitat in younger stands. Consequently, activities are encouraged if empirical information and modeling indicate that the development of late-successional habitat conditions will be accelerated. Interdisciplinary teams of wildlife biologists, silviculturists, and other specialists are encouraged to develop prescriptions that meet these criteria. General guidelines for silvicultural activities follow.

1. To safeguard the conservation benefits of Late-Successional Reserves, silvicultural activities should be directed at young stands where stocking, structure, or composition will prevent or significantly retard development of late-successional conditions. This will generally include stands that are composed of trees less than 10 to 12 inches dbh, show no significant development of a multiple-canopy tree structure, and were regenerated following harvest activity. There will be exceptions to these guidelines, and judgments on stands to be managed will vary according to forest type and stand history. Activities in other types of stands that do not meet the general guidelines can be considered, particularly where those stands are heavily stocked and not being used by spotted owls or other late-successional associates. Examples may include stands that were planted following catastrophic fires or stands previously dominated by conifers that converted to hardwoods following harvest. Stands that have desired late-successional structure or that will soon develop it should not be treated unless such treatment is necessary to accomplish risk-reduction objectives (as described later).

2. Prescriptions to be used for each stand should be well thought out and documented. They will be designed to produce stand structure and components associated with late-successional conditions. These components include large trees, snags, logs, and dense, multi-storied canopies. Prescriptions should show the treatments to be applied and the anticipated effects on the stand over time. They should also include a discussion of the actions, coordination efforts, and oversight that will be necessary for successful implementation. This discussion should draw on previous efforts made to implement similar prescriptions. Finally, the prescriptions should identify key stand attributes or accomplishments that should be monitored. For example, if snags are to be created, or regeneration established, the accomplishment of these actions and their results should be monitored.

3. Silvicultural activities must maintain or reduce risk of large-scale natural disturbance. For example, activities should not be implemented if they significantly increase the risk of windthrow in a stand.

4. To promote late-successional structure in stands to be thinned, prescriptions will provide for leaving some trees as snags and others as down wood. Those trees not needed for habitat development may be removed for commercial or fuel hazard reasons.

5. Key attributes of late-successional forests are their diversity and variability on individual sites and from site to site. To promote diversity and variability, a wide range of silvicultural practices should be applied, as opposed to reliance on a limited variety of techniques.

6. Activities that comply with these guidelines should provide positive conservation benefits. Actual implementation experience, however, is not extensive. A modest rate of implementation is prudent and will provide the opportunity to assess and refine activities. Acreage to be manipulated by silvicultural activities should generally be limited to 5 percent of the total area in any Late-Successional Reserve in the initial 5-year period of implementation, unless the need for larger-scale actions explicitly are justified.

7. Some habitat modification activities in Late-Successional Reserves will generate enough revenue to pay for themselves. Others will not and need to be supported by appropriated funds. It is not appropriate to conduct only those activities that generate a commercial return and ignore the needs of stands that cannot be treated commercially.

## Guidelines to reduce risks of large-scale disturbance

Large-scale disturbances are natural events, such as fire, that can eliminate owl habitat on hundreds or thousands of acres. Certain risk management activities, if properly planned and implemented, may reduce the probability of these major stand-replacing events. There is considerable risk of such events in Late-Successional Forest Reserves in the eastern Oregon Cascades, eastern Washington Cascades, and California Cascades provinces and a lesser risk in the Oregon Klamath and California Klamath provinces. Elevated risk levels are attributed to changes in the characteristics and distribution of the mixed-conifer forests resulting from past fire protection. These forests occur in drier environments, have had repeated insect infestations, and are susceptible to major fires. Risk reduction efforts are encouraged where they are consistent with the overall recommendations in this section.

Silvicultural activities aimed at reducing risk shall focus on younger stands in Late-Successional Forest Reserves. The objective will be to accelerate development of late-successional conditions while making the future stand less susceptible to natural disturbances. Salvage activities should focus on the reduction of catastrophic insect, disease, and fire threats. Treatments should be designed to provide effective fuel breaks wherever possible. However, the scale of salvage and other treatments should not generally result in degeneration of currently suitable owl habitat or other late-successional conditions.

In some Late-Successional Forest Reserves in these provinces, management that goes beyond these guidelines may be considered. Levels of risk in those Late-Successional Forest Reserves are particularly high and may require additional measures. Consequently, management activities designed to reduce risk levels are encouraged in those Late-Successional Forest Reserves even if a portion of the activities must take place in currently late-successional habitat. While risk-reduction efforts should generally be focused on young stands, activities in older stands may be appropriate if: (1) the proposed management activities will clearly result in greater assurance of long-term maintenance of habitat, (2) the activities are clearly needed to reduce risks, and (3) the activities will not prevent the Late-Successional Forest Reserves from playing an effective role in the objectives for which it was established.

## Guidelines for salvage

Salvage is defined as the removal of trees from an area following a stand-replacing event caused by wind, fires, insect infestations, volcanic eruptions, or diseases. Salvage guidelines are intended to prevent negative effects on late-successional habitat, while permitting some commercial wood volume removal. In some cases, salvage operations may actually facilitate habitat recovery. For example, excessive amounts of coarse woody debris may interfere with stand regeneration activities following some disturbances. In other cases, salvage may help reduce the risk of future stand-replacing disturbances. Priority should be given to salvage in areas where it will have a positive effect on late-successional forest habitat, but salvage operations should not diminish habitat suitability now or in the future.

Tree mortality is a natural process in a forest ecosystem. Diseased and damaged trees are key structural components of late-successional forests. Accordingly, management planning for Late-Successional Reserves must acknowledge the considerable value of retaining dead and dying trees in the forest as well as the benefits from salvage activities.

In all cases, planning for salvage should focus on long-range objectives, which are based on desired future condition of the forest. Since Late-Successional Reserves have been established to provide high-quality habitat for species associated with late-successional forest conditions, management following a stand-replacing event should be designed to accelerate or not impede the development of those conditions. The rate of development of this habitat will vary among provinces and forest types and will be influenced by a complex interaction of stand-level factors that include site-productivity, population dynamics of live trees and snags, and decay rates of coarse woody debris. Because there is much to learn about the development of species associated with these forests and their habitat, it seems prudent to only allow removal of conservative quantities of salvage material from Late-Successional Reserves and retain management options until understanding of the process has improved.

The following guidelines are general. Specific guidelines should be developed for each physiographic province, and possibly for different forest types within provinces.

1. The potential for benefit to species associated with late-successional forest conditions from salvage is greatest when stand-replacing events are involved. Salvage in small disturbed sites is not appropriate because small forest openings are an important component of old-growth forests. Depending on the option, salvage is not permitted in disturbed sites that are either less than 10 acres or less then 100 acres. In addition, salvage should occur only in stands where disturbance has reduced canopy closure to less than 40 percent, as stands with more closure are likely to provide some value for species associated with these forests.

2. Surviving trees will provide a significant residual of larger trees in the developing stand. In addition, defects caused by fire in residual trees may accelerate development of structural characteristics suitable for associated species. Also, those damaged trees that eventually die will provide additional snags. Consequently, all standing live trees should be retained, including those injured (e.g., scorched) but likely to survive. Inspection of the cambium layer can provide an indication of potential tree mortality.

3. Snags provide a variety of habitat benefits for a variety of wildlife species associated with late-successional forests. Accordingly, following stand-replacing disturbance, management should focus on retaining snags that are likely to persist until late-successional conditions have developed and the new stand is again producing large snags. Late-successional conditions are not associated with stands less then 80 years old.

4. Following a stand replacing disturbance, management should retain adequate coarse woody debris quantities in the new stand so that in the future it will still contain amounts similar to naturally regenerated stands. The analysis that determines the amount of coarse woody debris to leave must account for the full period of time before the new stand begins to contribute coarse woody debris. As in the case of snags, province level specifications must be provided for this guideline. Since coarse woody debris decay rates, forest dynamics, and site productivity undoubtedly will vary among provinces and forest types, the specifications also will vary.

5. Some salvage that does not meet the preceding guidelines will be allowed when salvage is essential to reduce the future risk of fire or insect damage to late-successional forest conditions. This circumstance is most likely to occur in the eastern Oregon Cascades, eastern Washington Cascades, and California Cascades provinces, and somewhat less likely to occur in the Oregon Klamath and California Klamath provinces. It is important to understand that some risk associated with fire and insects is acceptable because they are natural forces influencing late-successional forest

development. Consequently, salvage to reduce such risks should focus only on those areas where there is high risk of large scale disturbance.

6. Removal of snags and logs may be necessary to reduce hazards to humans along roads and trails and in or adjacent to campgrounds. Where materials must be removed from the site, as in a campground, a salvage sale is appropriate. In other areas, such as along roads, leaving material on site should be considered. Also, material will be left where available coarse woody debris is inadequate.

7. Where green trees, snags, and logs are present following disturbance, the green tree and snag guidelines will be applied first, and completely satisfied where possible. The biomass left in snags can be credited toward the amount of coarse woody debris biomass needed to achieve management objectives.

8. These basic guidelines may not be applicable after disturbances in younger stands since remnant coarse woody debris may be relatively small. In these cases, diameter and biomass retention guidelines should be developed consistent with the intention of regenerating late-successional forest conditions.

9. Logs present on the forest floor before a disturbance event provide habitat benefits that are likely to continue. It seldom will be appropriate to remove them. Where these logs are in an advanced state of decay, they will not be credited toward objectives for coarse woody debris retention developed after a disturbance event. Advanced state of decay should defined as logs not expected to persist to the time when the new stand begins producing coarse woody debris.

10. The coarse woody debris retained should approximate the species composition of the original stand to help replicate preexisting suitable habitat conditions.

11. Some deviation from these general guidelines may be allowed to provide reasonable access to salvage sites and feasible logging operations. Such deviation should occur on as small a portion of the area as possible, and should not result in violation of the basic intent that late-successional forest habitat or the development of future such habitat should not be impaired throughout the area. While exceptions to the guidelines may be allowed to provide access and operability, some salvage opportunities will undoubtedly be foregone because of access, feasibility, and safety concerns.

# 6. AQUATIC CONSERVATION STRATEGY

*The Aquatic Conservation Strategy was developed to protect salmon and steelhead habitat on all public lands (Forest Service, Bureau of Land Management, Park Service) within the range of Pacific Ocean anadromy, and is a refinement of the approach outlined in Appendix 5-K of Thomas et al. (1993). The following description of the strategy, its components, objectives, and applicable standards and guidelines is excerpted from Chapter V of the FEMAT Report (Appendix A).*

*Riparian Reserve standards and guidelines are minimum land management prescriptions necessary to meet Aquatic Conservation Strategy objectives. The Riparian Reserve standards and guidelines were developed by a field team of managers and specialists and a technical team of scientists, and ratified by a validation team of managers and field scientists. They have been reviewed and revised by representatives of both the Bureau of Land Management and the Forest Service, with participation of the Forest Ecosystem Management Assessment Team - Aquatic/Watershed Group.*

## Aquatic Conservation Strategy, Objectives, and Standards and Guidelines

This conservation strategy is aimed at restoring and maintaining the ecological health of watersheds (Karr et al. 1986, Karr 1991, Naiman et al. 1992). The strategy was designed to provide a scientific basis for protecting aquatic ecosystem and enables planning for sustainable resource management. It is a region-wide strategy seeking to retain, restore, and protect those processes and landforms that contribute habitat elements to streams and promote good habitat conditions for fish and other aquatic and riparian-dependent organisms. The foundation of the conservation strategy is a refinement of the approach outlined in Thomas et al. (1993).

An effective conservation strategy must protect aquatic ecosystem functions and processes, organized at a watershed scale, while recognizing that land ownership patterns rarely coincide with the distinct topographic boundaries of watersheds. Any conservation strategy that attempts to protect all components of the aquatic ecosystem ranging from unstable and potentially unstable areas in the uplands to mainstem riparian forests must be extensive and comprehensive. Decision criteria for protection, monitoring and restoration must be included.

At the heart of this approach is the recognition that fish and other aquatic organisms evolved within a dynamic environment that has been constantly influenced and changed by geomorphic and ecologic disturbances. Stewardship of aquatic resources has the highest likelihood of protecting biological diversity and productivity when land use activities do not substantially alter the natural disturbance regime to which these organisms are adapted (Swanson et al. in press).

This conservation strategy employs several tactics with which to approach the goal of maintaining the "natural" disturbance regime. Land-use activities need to be limited or excluded in parts of the watershed prone to instability. The distribution of land-use activities, such as timber harvest or roads, must minimize increases in peak streamflows. Headwater riparian zones need to be protected, so that when debris slides and flows occur they contain large wood and boulders necessary for creating habitat farther downstream. Riparian zones along larger channels need protection to limit bank erosion, ensure an adequate and continuous supply of large wood to channels, and provide shade and microclimate protection. Watersheds currently containing the best habitat or with the greatest potential for recovery should receive increased protection and be priorities for restoration programs.

Current scientific understanding of fish habitat relationships is inadequate to allow definition of specific habitat requirements for fish throughout their life cycle at the watershed level. Some general habitat needs of fish are well known, such as deep resting pools, cover, certain temperature ranges, food supply, and clean gravels for spawning (Bjornn and Reiser 1991). However, we cannot specify how these habitats and conditions should be distributed through time and space to provide for fish needs. In natural watersheds, different species and age-classes interact with multiple habitat elements in complex ways. This interaction occurs within a landscape where the quality and distribution of habitat elements change with time in relation to disturbance processes and land-use imposed changes on streams and riparian zones.

We believe that any species-specific strategy aimed at defining explicit standards for habitat elements would be insufficient for protecting even the targeted species. To succeed, any Aquatic Conservation Strategy must strive to maintain and restore ecosystem health at watershed and landscape scales. Thus, this is the approach the conservation strategy proposed here employs. This approach seeks to prevent further degradation and restore habitat over broad landscapes as opposed to individual projects or small watersheds. We emphasize, however, that it will require time for this strategy to work. Because it is based on natural disturbance processes, it may take decades to over a century to accomplish all of its objectives. Some improvements in aquatic ecosystems, however, can be expected in 10 to 20 years. We believe that if this approach is conscientiously implemented, it will protect habitat for fish and other riparian-dependent species resources and restore currently degraded habitats.

## Aquatic Conservation Strategy Objectives

Federal lands within the range of the northern spotted owl will be managed to:

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These lineages must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain in the range that maintains system the biological, physical, and chemical integrity and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

5. Maintain and restore the sediment regime under which aquatic system evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate

rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of large wood sufficient to sustain physical complexity and stability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Components of the Aquatic Conservation Strategy

1. **Riparian Reserves:** Lands along streams and unstable and potentially unstable areas where special Standards and Guidelines govern land-use.

2. **Key Watersheds:** A system of large refugia comprising watersheds that are crucial to at-risk fish species and stocks and for high quality water.

3. **Watershed Analysis:** Procedures for conducting analysis that evaluate geomorphic and ecologic processes operating in specific watersheds. This should enable watershed planning that achieves Aquatic Conservation Strategy Objectives. Watershed Analysis provides the basis for monitoring and restoration programs and the foundation from which Riparian Reserves can be delineated.

4. **Watershed Restoration:** A comprehensive, long-term program of watershed restoration to restore watershed health, riparian ecosystems, and fish habitats.

These components are designed to operate together to maintain and restore the productivity and resilience of riparian and aquatic ecosystems. Late-Successional Reserves are also an important component of the Aquatic Conservation Strategy. The Standards and Guidelines under which Late-Successional Reserves are managed provide increased protection for all stream types. Since these Reserves possess late-successional characteristics, they offer core areas of good stream habitat that will act as refugia and centers from which degraded areas can be recolonized as they recover. Streams in these Reserves may be particularly important for endemic or locally distributed fish species and stocks (see Table V-12).

### 1) Riparian Reserves

Riparian Reserves are portions of watersheds where riparian-dependent resources receive primary emphasis and where special Standards and Guidelines apply. Standards and Guidelines prohibit activities in Riparian Reserves that retard or prevent attainment of the Aquatic Conservation Strategy Objectives. Riparian Reserves include those portions of a watershed directly coupled to streams and rivers, that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect streams, stream processes, and fish habitats. Riparian Reserves include the current land resource management riparian management zones or streamside management zones and primary source areas for wood and sediment such as unstable and potentially unstable areas in headwater areas and along streams.

Under the Aquatic Conservation Strategy, Riparian Reserves are used to maintain and restore riparian structures and functions of intermittent streams, confer benefits to riparian-dependent and associated species other than fish, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the watershed.

Interim widths for Riparian Reserves of different waterbodies are established based on ecological and geomorphic factors. Interim widths are designed to provide a high level of fish habitat and riparian protection until watershed and site-analysis can be completed. Interim widths of Riparian Reserves for all watersheds apply until Watershed Analysis is completed, a site-specific analysis is conducted and described, and the rationale for final Riparian Reserve boundaries is presented.

Thomas et al. (1993) defined site-potential tree as a tree that has attained the maximum height possible given the site conditions where it occurs. FEMAT redefined a site-potential tree height as the average maximum height of the tallest dominant trees (200 years or more) for a given site class..

Five types of streams or water bodies and interim widths of Riparian Reserves for each are:

- *Fish-bearing streams* - Riparian Reserves consist of the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest.

- *Permanently flowing non-fish-bearing streams* - Riparian Reserves consist of the stream and the area on either side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or depending upon the Riparian Reserve scenario-extension from the edges of a stream channel to a distance equal to the height of some fraction of a site-potential tree, or a specified slope distance, whichever is greatest.

- *Constructed ponds and reservoirs, and wetlands greater than 1 acre* - Riparian Reserves consist of the body of water or wetland and the area from the outer edges of the riparian vegetation, or to the extent of seasonally saturated soil, or to the extent of unstable and potentially unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance for wetlands greater than 1 acre, and from the edge of the maximum pool elevation of constructed ponds and reservoirs, whichever is greatest.

- *Lakes and Natural Ponds* - Riparian Reserves consist of the body of water or wetland and the area from the outer edges of the riparian vegetation, or to the extent of seasonally saturated soil, or to the extent of unstable and potentially unstable areas, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance, whichever is greatest. This is the same in all Riparian Reserve scenarios.

- *Seasonally flowing or intermittent streams, wetlands less than 1 acre, and unstable and potentially unstable areas* - This category applies to features with high variability in size and site-specific characteristics. At a minimum the Riparian Reserve must include:

  - The extent of unstable and potentially unstable areas.

  - The stream channel and extend to the top of the inner gorge.

  - The stream channel or wetland and the area from the edges of the stream channel or wetland to the outer edges of the riparian vegetation.

  - Depending upon the Riparian Reserve scenario, extension from the edges of the stream channel to a distance equal to the height of some fraction of a site-potential tree, or a specified slope distance, whichever is greatest.

**Intermittent Streams.** Intermittent streams are defined as any non-permanent flowing drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.

Watershed Analysis provides the ecological and geomorphic basis for changing the size and location of interim Riparian Reserves. Watershed Analysis will identify critical hillslope, riparian, and channel processes in order to delineate Riparian Reserves that assure protection of riparian and aquatic functions. The ultimate design of

Riparian Reserves is likely to be a hybrid of decisions based on consideration of sites of special ecological value, slope stability and natural disturbance processes. Within a given physiographic province, similar geologic, climatic, and topographic features control drainage network and hillslope stability patterns. These features will exert a strong influence on design of Riparian Reserves.

Analysis of site specific characteristics may warrant Riparian Reserves that are narrower or wider than the interim widths. Although Riparian Reserve boundaries may be adjusted on permanently flowing streams, the interim widths are expected to approximate those necessary for attaining Aquatic Conservation Strategy Objectives. Intermittent streams are highly variable in the degree to which a particular stream affects the hydrologic, geomorphic and ecologic processes in a watershed. Thus, Aquatic Conservation Strategy Objectives may be met with post-analysis reserve boundaries that are quite different from the interim. Changes to Riparian Reserves must be based on scientifically sound reasoning and fully justified and documented.

### 2) Key Watersheds

Refugia, or designated areas providing high quality habitat, either currently or in the future, are a cornerstone of most species conservation strategies. A system of Key Watersheds that serve as refugia is crucial for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species. These refugia include areas of good habitat as well as areas of degraded habitat. Areas presently in good condition will serve as anchors for the potential recovery of depressed stocks. Those of lower quality habitat have a high potential for restoration and will become future sources of good habitat with the implementation of a comprehensive restoration program (see component 4).

The Aquatic Conservation Strategy includes two designations for Key Watersheds. Tier 1 (Aquatic Conservation Emphasis) Key Watersheds contribute directly to conservation of at-risk anadromous salmonids, bull trout, and resident fish species. The network of 139 Tier 1 Key Watersheds ensures that refugia are widely distributed across the landscape. Twenty-three Tier 2 (other) Key Watersheds may not contain at-risk fish stocks, but are important sources of high quality water.

All Key Watersheds require Watershed Analysis prior to further resource management activity; except that in the short-term, until Watershed Analysis can be completed, minor activities such as those that would be Categorically Excluded under NEPA regulations may proceed, applying interim Riparian Reserves and Standards and Guidelines. Key Watersheds that currently contain poor habitat are believed to have the best opportunity for successful restoration and will receive priority in any watershed restoration program.

**Roadless areas and Key Watersheds**
Management activities in roadless areas with unstable land will increase the risk to aquatic and riparian habitat land, impair the capacity of Key Watersheds to function as intended, and limit the potential to achieve Aquatic Conservation Strategy objectives.

To protect the remaining high quality habitats, no new roads will be constructed in roadless areas in Key Watersheds under all options except Options 7 and 8. Watershed analysis must be conducted in all non-Key Watersheds which contain roadless areas before any management activities can occur within those roadless areas.

It is recommended that existing system and nonsystem road mileage within Key Watersheds be reduced. If funding is insufficient to implement reductions, there will be no net increase in road mileage in Key Watersheds. That is, for each mile of new road construction, at least one mile of road should be decommissioned (see also Appendix A: FEMAT Report - V, Appendix J), with priority for roads that pose the greatest risks to riparian and aquatic ecosystems.

### 3) Watershed Analysis

Watershed Analysis is a systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives. This information then may guide management prescriptions, including setting and refining boundaries of riparian and other reserves, developing restoration strategies and priorities, and revealing the most useful indicators for monitoring environmental changes. Watershed Analysis is a stratum of ecosystem planning applied to watersheds of approximately 20-200 square miles (Figure B-1, from Figure V-23 in the FEMAT Report). It is a key component in watershed planning, a process for melding social expectations with the biophysical capabilities of specific landscapes.

Watershed Analysis is only required in Key Watersheds prior to land management. Ultimately however, Watershed Analysis should be conducted in all watersheds on federal lands as a basis for ecosystem planning and management. Current Land Management Plans will be revised, in part, on the basis of information gathered through Watershed Analysis. Watershed Analysis holds great promise as a means of effectively implementing ecosystem planning and management on a watershed basis. Information gained through Watershed Analysis will be vital to adaptive management over broad physiographic regions. Developing the institutional capacity to absorb and respond to new information generated by watershed and other analyses represents a significant challenge for the next decades.

Watershed Analysis is a set of technically rigorous and defensible procedures designed to provide information on what processes are active within a watershed, how those processes are distributed in time and space, what the current upland and riparian conditions of the watershed are, and how all of these factors influence riparian habitat and other beneficial uses. The analysis is conducted by an interdisciplinary team consisting of geomorphologists, hydrologists, soil scientists, biologists and other specialists as needed. Information used in this analysis includes: maps of topography, stream networks, soils, vegetation, geology; sequential aerial photographs; field inventories and surveys, including landslide, channel, aquatic habitat, and riparian condition inventories; census data on species presence and abundance; disturbance and land use history; and other historical data (e.g., streamflow records, old channel surveys).

Watershed Analysis is organized as a set of modules that examine biotic and abiotic processes influencing aquatic habitat and species abundance (i.e., landslides, surface erosion, peak and low streamflows, stream temperatures, road network effects, woody debris dynamics, channel processes, fire, limiting factor analysis for key species, and so on). Results from these modules are integrated into a description of current upland, riparian, and channel conditions, maps of location, frequency, and magnitude of key processes, and location and abundance of key species.

Watershed Analysis is then used at the site level, to set appropriate boundaries of Riparian Reserves, plan land-use activities compatible with disturbance patterns, design road transportation networks that pose minimal risk, identify what and where restoration activities will be most effective, and establish specific parameters and activities to be monitored. More detailed site-level analysis is conducted to provide the information and designs needed for specific projects (e.g., road siting or timber sale layout) so that riparian and aquatic habitats are protected.

While Watershed Analysis can provide essential information for designing land-use activities over the entire watershed, it will also highlight uncertainties in knowledge or understanding that need to be addressed. Watershed Analysis is emerging as a new standard for assessing watershed condition and land use impacts. The process described here builds on newer, more comprehensive approaches, including the Water Resources Evaluation of Nonpoint Silvicultural Sources program, the Watershed Analysis procedure developed by the Washington State Timber, Fish and Wildlife program, and the cumulative effects methods being developed by the National Council on Air and Stream Improvement. Analysis modules in Watershed Analysis are patterned

## Figure V-23. Context for Watershed Analysis.

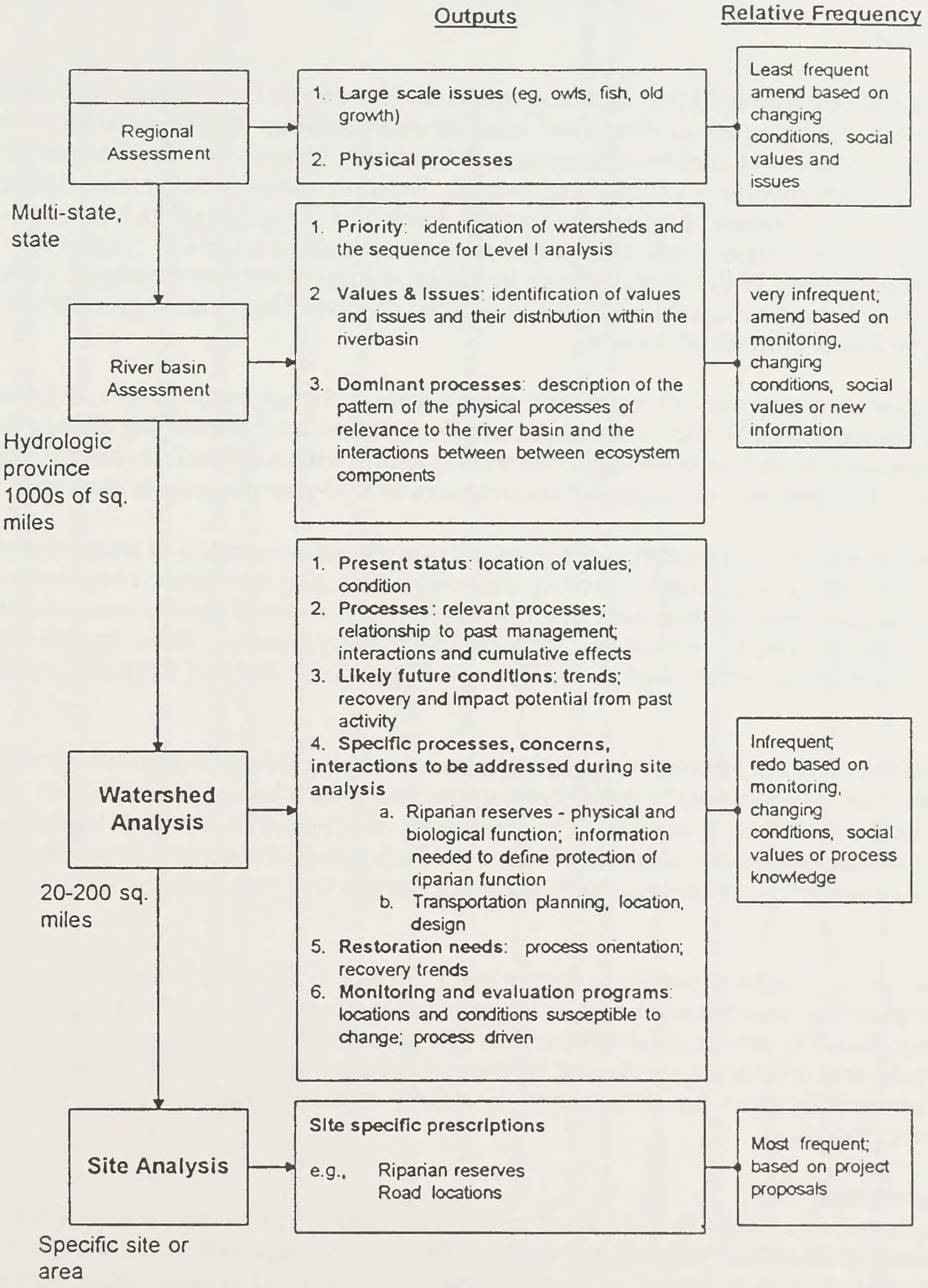

Outputs
Relative Frequency
Regional Assessment
Multi-state, state
1. Large scale issues (eg, owls, fish, old growth)
2. Physical processes
Least frequent amend based on changing conditions, social values and issues
River basin Assessment
Hydrologic province 1000s of sq. miles
1. Priority: identification of watersheds and the sequence for Level I analysis
2 Values & Issues: identification of values and issues and their distribution within the riverbasin
3. Dominant processes: description of the pattern of the physical processes of relevance to the river basin and the interactions between between ecosystem components
very infrequent; amend based on monitoring, changing conditions, social values or new information
Watershed Analysis
20-200 sq. miles
1. Present status: location of values; condition
2. Processes: relevant processes; relationship to past management; interactions and cumulative effects
3. Likely future conditions: trends; recovery and impact potential from past activity
4. Specific processes, concerns, interactions to be addressed during site analysis
a. Riparian reserves - physical and biological function; information needed to define protection of riparian function
b. Transportation planning, location, design
5. Restoration needs: process orientation; recovery trends
6. Monitoring and evaluation programs: locations and conditions susceptible to change; process driven
Infrequent; redo based on monitoring, changing conditions, social values or process knowledge
Site Analysis
Specific site or area
Site specific prescriptions
e.g., Riparian reserves
Road locations
Most frequent; based on project proposals

Figure V-23. Context for Watershed Analysis.

after the first two approaches because a modular approach allows flexibility in selecting methods appropriate to a particular watershed and facilitates modification of specific techniques as improved methods become available. Unique aspects of the Watershed Analysis procedure described here include explicit consideration of biological as well as physical processes, and the joint consideration of upland and riparian zones (see also FEMAT Report V - Appendix I).

### 4) Watershed Restoration

Watershed Restoration will be an integral part of a program to aid recovery of fish habitat, riparian habitat, and water quality. Restoration will be based on Watershed Analysis and planning. This is essential to identify areas of greatest benefit to cost and greatest likelihood of success. Watershed Analysis can also be used as a medium to develop cooperative projects involving various land owners. In many watersheds the most critical restoration needs are on private lands downstream of federal ownership. Decisions to apply a given treatment depend on the value and sensitivity of downstream uses, transportation needs, social expectations, "treatability" of the problems, costs, and other factors. Watershed Analysis, including the use of sediment budgets, provides a framework for considering benefit to cost relations in a watershed context. Thus, the magnitude of regional restoration needs will be based Watershed Analysis.

A viable, effective program must employ all restoration components and must be long term. Inventory, analysis, the National Environmental Policy Act process, implementation, and monitoring all take time. Without adequate investment in each of these steps, restoration efforts will be ineffective--ample evidence demonstrates this point. Funding and management commitment to a 10-year program is essential.

The most important components of a restoration program are control and prevention of road-related runoff and sediment production; restoration of the condition of riparian vegetation; and restoration of in-stream habitat complexity. Other restoration opportunities exist, such as meadow and wetland restoration and mine reclamation, and these may be quite important in some areas. Regionally however, these opportunities are much less extensive than the three components listed above (see also Appendix A: FEMAT Report V Appendix J).

#### Roads

Road treatments range from full decommissioning (closing and stabilizing a road to eliminate potential for storm damage and need for maintenance) to simple road upgrading, which leaves the road open. Upgrading can involve practices such as removal of earth from locations with high potential to trigger landslides, modification of road drainage systems to reduce the extent to which the road functions as an extensions of the stream network, and reconstructing stream crossings to reduce the risk and consequences of failure.

#### Riparian Vegetation

Active silvicultural programs will be necessary to restore large conifers in Riparian Reserves. Appropriate practices may include planting unstable areas such as streamside landslides and flood terraces, thinning densely-stocked young stands to encourage development of large conifers, releasing young conifers from overtopping hardwoods, and reforesting shrub- and hardwood-dominated stands with conifers. These practices can be implemented along with silvicultural treatments in uplands areas, although the practices will differ in objective and, therefore, design.

#### In-stream Habitat Structures

In-stream restoration, based on accurately interpreted physical and biological processes and deficiencies, can be an important component of an overall program for restoring fish and riparian habitat. In-stream restoration measures are inherently short term and must be accompanied by riparian and upslope restoration to achieve long-term watershed restoration. Maintaining desired levels of channel habitat complexity, for example, may best be achieved in the short term with introduced structures. However, a healthy riparian forest should be the source of large woody debris to the channel in the long-term.

In-stream restoration, including in-channel structures, will not be used as mitigation or a substitute for habitat protection or to justify risky land-management activities and practices. Priority must be given to protecting existing good habitat.

**Table V-12.** Summary of Aquatic Conservation Strategy

| Component | Role in Conservation Strategy |
|---|---|
| Riparian Reserves | • Portions of the landscape where riparian dependent and stream resources receive primary emphasis<br>• Designated for all permanently flowing streams, lakes, wetlands greater than one acre, and intermittent streams<br>• Includes the body of water, inner gorge, all riparian vegetation, 100-year floodplain, landslides and landslide prone areas<br>• Interim widths will be at least some fraction of a site potential tree or a prescribed slope distance (See Table V-5)<br>• Standards and Guidelines prohibits programmed timber harvest, and manages roads, grazing, mining and recreation to achieve objectives of the Aquatic Conservation Strategy |
| Key Watersheds | • Tier 1 - Selected for directly contributing to anadromous salmonid and bull trout conservation<br>• Tier 2 - May not contain at risks fish stocks but were selected as sources of high quality water<br>• Inside roadless areas - no new roads will be built<br>• Outside roadless areas - at a minimum, there will be no net increase in roads in Key Watersheds<br>• Receives highest priority in restoration programs |
| Watershed Analysis | • A systematic procedure to characterize watersheds. The information guides management prescriptions, setting and refining Riparian Reserve boundaries, development of restoration strategies and monitoring programs<br>• Required in Key Watersheds prior to resource management<br>• Required in roadless areas prior to resource management<br>• Recommended in all other watersheds<br>• Required to change Riparian Reserve boundaries in all watersheds |
| Watershed Restoration | • Restore watershed processes to recover degraded habitat<br>• Focus on road removal and upgrading<br>• Silviculture treatments may be used to restore large conifers in Riparian Reserves<br>• Restore channel complexity. In-stream structures should only be used in the short term and not as mitigation for poor land management practices |

## Standards and Guidelines for Riparian Reserves

### Timber Management

TM-1. Prohibit timber harvest, including fuelwood cutting, in Riparian Reserves, except as described below. Riparian Reserves shall not be included in calculations of the timber base.

a. Where catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, allow salvage and fuelwood cutting if required to attain Aquatic Conservation Strategy Objectives.

b. Remove salvage trees only when Watershed Analysis determines that present and future woody debris needs are met and other Aquatic Conservation Strategy Objectives are not adversely affected.

c. Apply silvicultural practices for Riparian Reserves to control stocking, reestablish and culture stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy Objectives.

### Roads Management

RF-1. Cooperate with federal, state, and county agencies to achieve consistency in road design, operation, and maintenance necessary to attain Aquatic Conservation Strategy Objectives.

RF-2. For each existing or planned road, meet Aquatic Conservation Strategy Objectives by:

a. minimizing road and landing locations in Riparian Reserves.

b. completing watershed analyses (including appropriate geotechnical analyses) prior to construction of new roads or landings in Riparian Reserves.

c. preparing road design criteria, elements, and standards that govern construction and reconstruction.

d. preparing operation and maintenance criteria that govern road operation, maintenance, and management.

e. minimizing disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow.

f. restricting sidecasting as necessary to prevent the introduction of sediment to streams.

RF-3. Determine the influence of each road on the Aquatic Conservation Strategy Objectives through Watershed Analysis. Meet Aquatic Conservation Strategy Objectives by:

a. reconstructing roads and associated drainage features that pose a substantial risk.

b. prioritizing reconstruction based on current and potential impact to riparian resources and the ecological value of the riparian resources affected.

c. closing and stabilizing, or obliterating and stabilizing roads based on the on-going and potential effects to Aquatic Conservation Strategy Objectives and considering short-term and long-term transportation needs.

RF-4. New culverts, bridges and other stream crossings shall be constructed, and existing culverts, bridges and other stream crossings determined to pose a substantial risk to riparian conditions will be improved, to accommodate at least the 100-year flood, including associated bedload and debris. Priority for upgrading will be based on the potential impact and the ecological value of the riparian resources affected. Crossings will be constructed and maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.

RF-5. Minimize sediment delivery to streams from roads. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is infeasible or unsafe. Route road drainage away from potentially unstable channels, fills, and hillslopes.

RF-6. Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.

RF-7. Develop and implement a Road Management Plan or a Transportation Management Plan that will meet the Aquatic Conservation Strategy Objectives. As a minimum, this plan shall include provisions for the following activities:

a. post-storm inspections and maintenance.

b. during-storm inspections and maintenance.

c. road operation and maintenance giving high priority to identifying and correcting road drainage problems that contribute to degrading riparian resources.

d. regulation of traffic during wet periods to prevent damage to riparian resources.

e. establish the purpose of each road by developing the Road Management Objective.

### Grazing Management

GM-1. Adjust grazing practices to eliminate impacts that retard or prevent attainment of Aquatic Conservation Strategy Objectives. If adjusting practices is not effective, eliminate grazing.

GM-2. Locate new livestock handling and/or management facilities outside Riparian Reserves. For existing livestock handling facilities inside the Riparian Reserve, ensure that Aquatic Conservation Strategy Objectives are met. Where these objectives cannot be met, require relocation or removal of such facilities.

GM-3. Limit livestock trailing, bedding, watering, loading, and other handling efforts to those areas and times that will ensure Aquatic Conservation Strategy Objectives are met.

### Recreation Management

RM-1. Design, construct, and operate recreation facilities, including trails and dispersed sites, within Riparian Reserves in a manner that contributes to attainment of Aquatic Conservation Strategy Objectives. For existing recreation facilities inside Riparian Reserves, ensure that Aquatic Conservation Strategy Objectives are met. Where Aquatic Conservation Strategy Objectives cannot be met, require relocation or closure of recreation facilities.

RM-2. Adjust dispersed and developed recreation practices that retard or prevent attainment of Aquatic Conservation Strategy Objectives. Where adjustment measures such as education, use limitations, traffic control devices, increased maintenance, relocation of facilities, and/or specific site closures are not effective, eliminate the practice or occupancy.

RM-3. Wild and Scenic Rivers and Wilderness Management plans will address attainment of Aquatic Conservation Strategy Objectives.

**Minerals Management**

MM-1. Require a reclamation plan, approved Plan of Operations, and reclamation bond for all minerals operations that include Riparian Reserves. Such plans and bonds must address the costs of removing facilities, equipment, and materials; recontouring of disturbed areas to near pre-mining topography; isolation and neutralization or removal of toxic or potentially toxic materials; salvage and replacement of topsoil; and seedbed preparation and revegetation to meet Aquatic Conservation Strategy Objectives.

MM-2. Locate structures, support facilities, and roads outside Riparian Reserves. Where no alternative to siting facilities in Riparian Reserves exists, locate in a way compatible with Aquatic Conservation Strategy Objectives. Road construction will be kept to the minimum necessary for the approved mineral activity. Such roads will be constructed and maintained to meet Roads Management Standards and to minimize damage to resources in the Riparian Reserve. When a road is no longer required for mineral or land management activities, it will be closed, obliterated, and stabilized.

MM-3. Prohibit solid and sanitary waste facilities in Riparian Reserves. If no alternative to locating mine waste (waste rock, spent ore, tailings) facilities in Riparian Reserves exists, and releases can be prevented, and stability can be ensured, then:

a. analyze the waste material using the best conventional sampling methods and analytic techniques to determine it's chemical and physical stability characteristics.

b. locate and design the waste facilities using best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. If the best conventional technology is not sufficient to prevent such releases and ensure stability over the long term, prohibit such facilities in Riparian Reserves.

c. monitor waste and waste facilities after operations to ensure chemical and physical stability and to meet Aquatic Conservation Strategy Objectives.

d. reclaim waste facilities after operations to ensure chemical and physical stability and to meet Aquatic Conservation Strategy Objectives.

e. require reclamation bonds adequate to ensure long-term chemical and physical stability of mine waste facilities.

MM-4. For leasable minerals, prohibit surface occupancy within Riparian Reserves for oil, gas, and geothermal exploration and development activities where contracts and leases do not already exist. Adjust the operating plans of existing contracts to eliminate impacts that retard or prevent the attainment of Aquatic Conservation Strategy Objectives.

MM-5. Sand and gravel mining and extraction within Riparian Reserves will occur only if Aquatic Conservation Strategy Objectives can be met.

MM-6. Develop inspection and monitoring requirements and include such requirements in mineral plans, leases or permits. Evaluate the results of inspection and monitoring to modify mineral plans, leases and permits as needed to eliminate impacts that retard or prevent attainment of Aquatic Conservation Strategy Objectives.

## Fire/Fuels Management

FM-1. Design fuel treatment and fire suppression strategies, practices, and activities to meet Aquatic Conservation Strategy Objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management activities could be damaging to long-term ecosystem function.

FM-2. Locate incident bases, camps, helibases, staging areas, helispots and other centers for incident activities outside of Riparian Reserves. If the only suitable location for such activities is within the Riparian Reserve, an exemption may be granted following a review and recommendation by a resource advisor. The advisor will prescribe the location, use conditions, and rehabilitation requirements. Utilize an interdisciplinary team to predetermine suitable incident base and helibase locations.

FM-3. Minimize delivery of chemical retardant, foam, or additives to surface waters. An exception may be warranted in situations where over-riding immediate safety imperatives exist, or, following a review and recommendation by a resource advisor, when an escape would cause more long-term damage.

FM-4. Design prescribed burn projects and prescriptions to contribute to attainment of Aquatic Conservation Strategy Objectives.

FM-5. Immediately establish an emergency team to develop a rehabilitation treatment plan needed to attain Aquatic Conservation Strategy Objectives whenever Riparian Reserves are significantly damaged by a wildfire or a prescribed fire burning out of prescription.

## Lands

LH-1. Identify in-stream flows needed to maintain riparian resources, channel conditions, and fish passage.

LH-2. For hydroelectric and other surface water development proposals, require in-stream flows and habitat conditions that maintain or restore riparian resources, favorable channel conditions, and fish passage. Coordinate this process with the appropriate state agencies. During relicensing of hydroelectric projects, provide written and timely license conditions to Federal Energy Regulatory Commission (FERC) that require flows and habitat conditions that maintain/restore riparian resources and channel integrity. Coordinate relicensing projects with the appropriate state agencies.

LH-3. Locate new facilities outside of Riparian Reserves. For existing support facilities inside the Riparian Reserves that are essential to proper management, provide recommendations to FERC that ensure that Aquatic Conservation Strategy Objectives are met. Where these objectives cannot be met, provide recommendations to FERC that such support facilities should be relocated. Hydroelectric facilities that must be located in the Riparian Reserves will be located, operated, and maintained to eliminate adverse effects that retard or prevent attainment of Aquatic Conservation Strategy Objectives.

LH-4. Issue leases, permits, rights-of-way, and easements to avoid adverse effects that retard or prevent attainment of Aquatic Conservation Strategy Objectives. Adjust existing leases, permits, rights-of-way, and easements to eliminate adverse effects that retard or prevent the attainment of Aquatic Conservation Strategy Objectives. If adjustments are not effective, eliminate the activity. Priority for modifying existing leases, permits, rights-of-way and easements will be based on the actual or potential impact and the ecological value of the riparian resources affected.

LH-5. Use land acquisition, exchange, and conservation easements to meet Aquatic Conservation Strategy Objectives and facilitate restoration of fish stocks and other species at risk of extinction.

## General Riparian Area Management

RA-1. Identify and attempt to secure in-stream flows needed to maintain riparian resources, channel conditions, and aquatic habitat.

RA-2 Fell trees in Riparian Reserves when they pose a safety risk. Keep felled trees on-site when needed to meet woody debris objectives.

RA-3. Herbicides, insecticides, and other toxicants, and other chemicals shall be applied only in a manner that avoids impacts that retard or prevent attainment of Aquatic Conservation Strategy Objectives.

RA-4. Locate water drafting sites to minimize adverse effects on stream channel stability, sedimentation, and in-stream flows needed to maintain riparian resources, channel conditions, and fish habitat.

## Watershed and Habitat Restoration

WR-1. Design and implement watershed restoration projects in a manner that promotes long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and attains Aquatic Conservation Strategy Objectives.

WR-2. Cooperate with federal, state, local, and tribal agencies, and private landowners to develop watershed-based Coordinated Resource Management Plans or other cooperative agreements to meet Aquatic Conservation Strategy Objectives.

WR-3. Do not use mitigation or planned restoration as a substitute for preventing habitat degradation.

## Fish and Wildlife Management

FW-1. Design and implement fish and wildlife habitat restoration and enhancement activities in a manner that contributes to attainment of Aquatic Conservation Strategy Objectives.

FW-2. Design, construct and operate fish and wildlife interpretive and other user-enhancement facilities in a manner that does not retard or prevent attainment of Aquatic Conservation Strategy Objectives. For existing fish and wildlife interpretative and other user-enhancement facilities inside Riparian Reserves, ensure that Aquatic Conservation Strategy Objectives are met. Where Aquatic Conservation Strategy Objectives cannot be met, relocate or close such facilities.

FW-3. Cooperate with federal, tribal, and state wildlife management agencies to identify and eliminate wild ungulate impacts that are inconsistent with attainment of Aquatic Conservation Strategy Objectives.

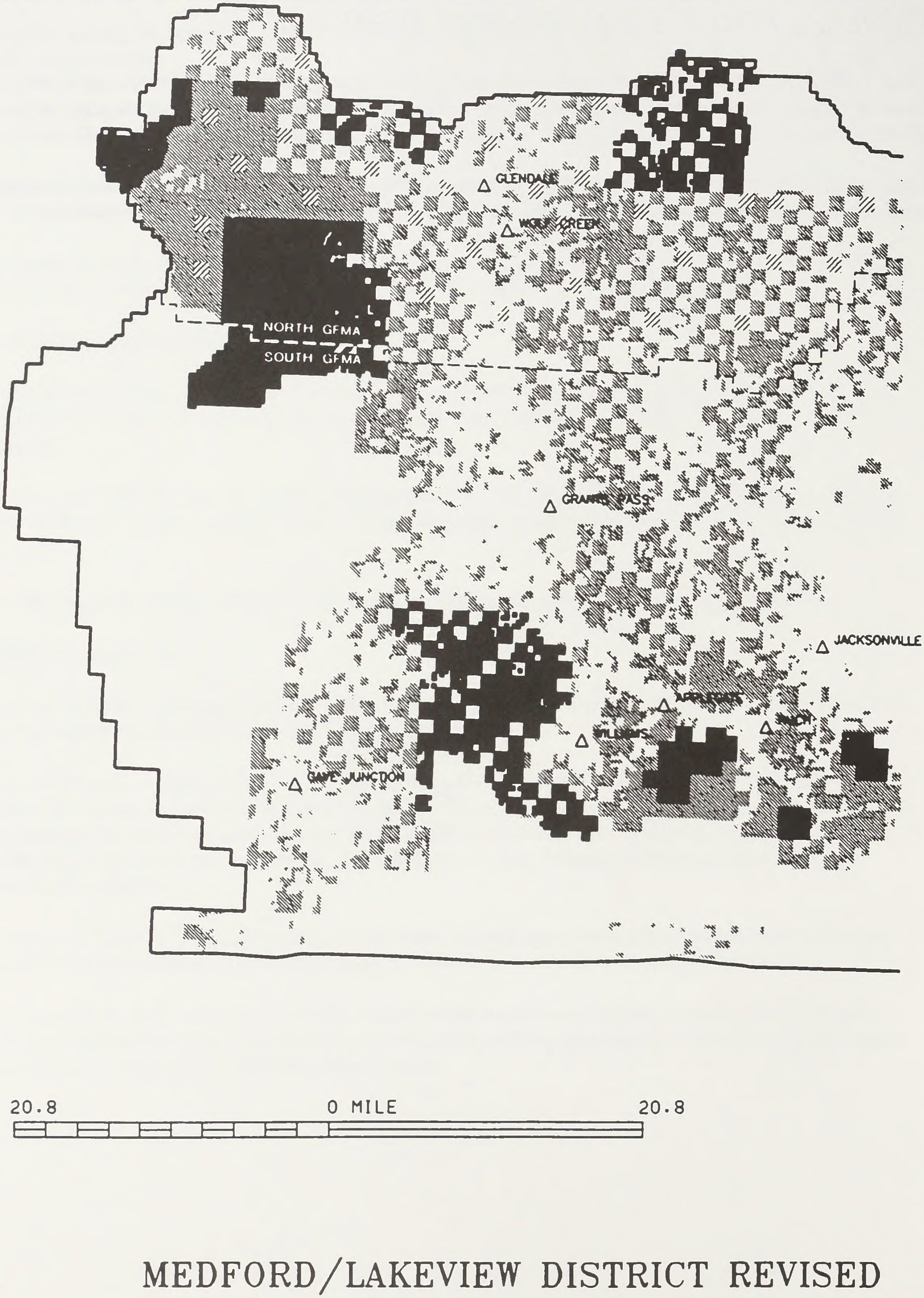
FW-4. Cooperate with federal, tribal, and state fish management agencies to identify and eliminate impacts associated with habitat manipulation, fish stocking, harvest and poaching that threaten the continued existence and distribution of native fish stocks inhabiting federal lands.

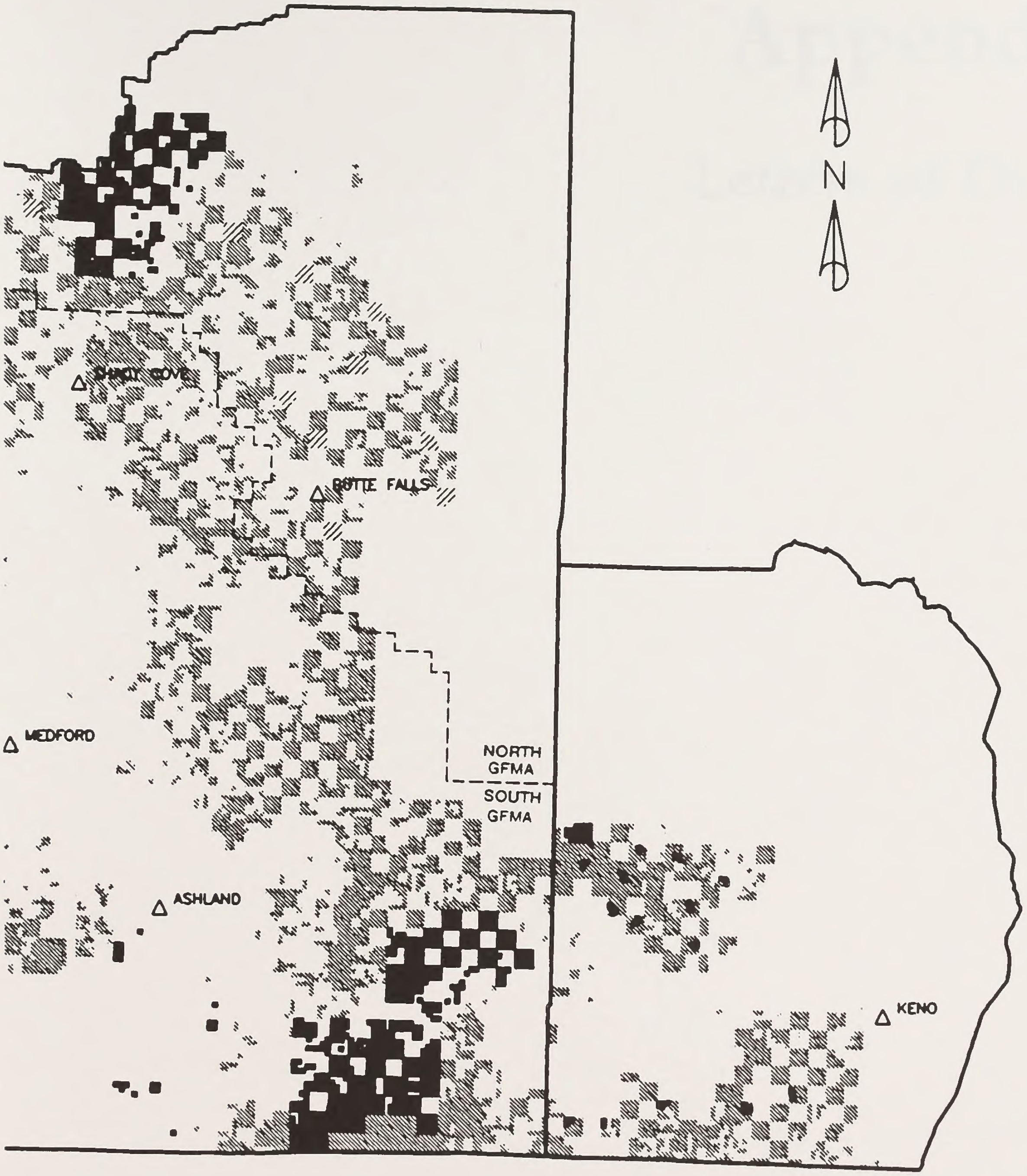
## 7. GRANTS PASS LINE - *LINE BETWEEN NORTHERN AND SOUTHERN GENERAL FOREST MANAGEMENT AREAS.*

*Lands in the BLM's Medford District which are allocated to timber management are divided into two separate categories based on site productivity, plant community, and forest condition. The line between these two categories is shown on the following map. Standards and guidelines differ on either side of this line and are described in Appendix B-1.*

*Lands north of this line fall into the generally more productive Northern General Forest Management Area, while lands south of this line, in the Southern General Forest Management Area, are generally less productive and dry.*

Figure B-6 Medford/Lakeview District Revised Draft Preferred Alternative.





**NOTE:** Conservation Areas are comprised of BLM Deferred & Non Deferred Old Growth Emphasis Areas, Recovery Plan Managed Pair Areas, Reserved Pair Areas, and Residual Habitat Areas.

**ALL LANDS DISPLAYED ARE BLM ADMINISTERED ONLY**

CONSERVATION AREAS ■
CONNECTIVITY BLOCKS ▨
GENERAL FOREST MGT AREAS ▧
MAJOR CITIES △

# DRAFT PREFERRED ALTERNATIVE

JUNE 1993

# Appendix C

## Letters of Direction

May 12, 1993

MEMORANDUM FOR CHIEF OF THE FOREST SERVICE
DIRECTOR OF THE BUREAU OF LAND MANAGEMENT

FROM: Mike Espy
Secretary of Agriculture

Bruce Babbitt
Secretary of the Interior

SUBJECT: SEIS on Forest Conference Alternatives

Since the Forest Conference, three inter-agency working groups have been convened to evaluate options for implementing policies discussed at the Forest Conference. The Ecosystem Management Assessment working group and the Labor and the Community Assistance working group will be submitting their reports about June 1.

To better assess the environmental effects of the options prepared by the Ecosystem Management Assessment working group and provide for additional public participation in this process, we are directing the Forest Service and Bureau of Land Management to immediately begin preparing a draft supplemental environmental impact statement (SEIS) on the options being developed by the Ecosystem Management Assessment working group. Among other things, the SEIS will supplement the Forest Service Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests (January 1992).

The Forest Service and Bureau of Land Management will be joint lead agencies on this SEIS, with the National Park Service, Fish and Wildlife Service, National Marine Fisheries Service, Environmental Protection Agency and other appropriate agencies as cooperating agencies. The interdisciplinary team will be led by Robert Jacobs of the Forest Service, with members from the Forest Service, Bureau of Land Management, and other agencies as appropriate.

The SEIS will encompass the consideration of (1) amendments to Forest Service Regional Guides and Forest Plans for maintenance of viability of old-growth related species within the range of the northern spotted owl and (2) standards for maintenance of viability of old-growth related species within the range of the northern spotted owl for use in Bureau of Land Management Resource and Management Plans.

The SEIS will take an ecosystem approach to forest management and discuss those issues outlined in the Statement of Mission for the Ecosystem Management Assessment working group (May 7, 1993) and disclose the environmental, economic and social consequences of the alternatives presented.

The rapid preparation of this SEIS is a high priority for our Departments. The preparation of the SEIS should be coordinated with the Ecosystem Management Assessment working group before its report is complete and should draw upon information previously collected in order to complete the draft SEIS as quickly as possible. The draft SEIS should be ready to release to the public by July 16. This schedule would allow time for the comment period to close by October 18, a final EIS to be issued by November 30, and decision documents to be issued by December 31, 1993.

May 7, 1993

TO: **FOREST CONFERENCE INTER-AGENCY WORKING GROUPS**
Ecosystem Management Assessment
Labor and Community Assistance
Agency Coordination

FROM: **FOREST CONFERENCE EXECUTIVE COMMITTEE**
Department of Agriculture
Department of Interior
Department of Labor
Department of Commerce
Environmental Protection Agency
Office on Environmental Policy
Office of Science and Technology
National Economic Council
Council of Economic Advisors
Office of Management and Budget

RE: **STATEMENT OF MISSION**

Together, we are working to fulfill President Clinton's mandate to produce a plan to break the gridlock over federal forest management that has created so much confusion and controversy in the Pacific Northwest and northern California. As well, that mandate means providing for economic diversification and new economic opportunities in the region. As you enter into the critical phase of your work reviewing options and policy, this mission statement should be used to focus and coordinate your efforts. It includes overall guidance and specific guidance for each team.

## BACKGROUND

President Clinton posed the fundamental question we face when he opened the Forest Conference in Portland.

"How can we achieve a balanced and comprehensive policy that recognizes the importance of the forests and timber to the economy and jobs in this region, and how can we preserve our precious old-growth forests, which are part of our national heritage and that, once destroyed, can never be replaced?"

And he said, "the most important thing we can do is to admit, all of us to each other, that there are no simple or easy answers. This is not about choosing between jobs and the environment, but about recognizing the importance of both and recognizing that virtually everyone here and everyone in this region cares about both.

The President said five principles should guide our work:

"First, we must never forget the human and the economic dimensions of these problems. Where sound management policies can preserve the health of forest lands, sales should go forward. Where this requirement cannot be met, we need to do our best to offer new economic opportunities for year-round, high-wage, high-skill jobs.

"Second, as we craft a plan, we need to protect the long-term health of our forests, our wildlife, and our waterways. They are, as the last speaker said, a gift from God; and we hold them in trust for future generations.

"Third, our efforts must be, insofar as we are wise enough to know it, scientifically sound, ecologically credible, and legally responsible.

"Fourth, the plan should produce a predictable and sustainable level of timber sales and non-timber resources that will not degrade or destroy the environment.

"Fifth, to achieve these goals, we will do our best, as I said, to make the federal government work together and work for you. We may make mistakes but we will try to end the gridlock within the federal government and we will insist on collaboration not confrontation."

## ECOSYSTEM MANAGEMENT ASSESSMENT

Our objectives based on the President's mandate and principles are to identify management alternatives that attain the greatest economic and social contribution from the forests of the region and meet the requirements of the applicable laws and regulations, including the Endangered Species Act, the National Forest Management Act, the Federal Land Policy Management Act, and the National Environmental Policy Act. The Ecosystem Management Assessment working group should explore adaptive management and silvicultural techniques and base its work on the best technical and scientific information currently available.

Your assessment should take an ecosystem approach to forest management and should particularly address maintenance and restoration of biological diversity, particularly that of the late-successional and old growth forest ecosystems; maintenance of long-term site productivity of forest ecosystems; maintenance of sustainable levels of renewable natural resources, including timber, other forest products, and other facets of forest values; and maintenance of rural economies and communities.

Given the biological requirements of each alternative, you should suggest the patterns of protection, investment, and use that will provide the greatest possible economic and social contributions from the region's forests. In particular, we encourage you to suggest innovative ways federal forests can contribute to economic and social well-being.

You should address a range of alternatives in a way that allows us to distinguish the different costs and benefits of various approaches (including marginal cost/benefit assessments), and in doing so, at least the following should be considered:

- timber sales, short and long term;
- production of other commodities;
- effects on public uses and values, including scenic quality, recreation, subsistence, and tourism;
- effect on environmental and ecological values, including air and water quality, habitat conservation, sustainability, threatened and endangered species, biodiversity and long-term productivity;
- jobs attributable to timber harvest and timber processing; and, to the extent feasible, jobs attributable to other commodity production, fish habitat protection, and public uses of forests; as well as jobs attributable to investment and restoration associated with each alternative;
- economic and social effects on local communities, and effects on revenues to counties and the national treasury,
- economic and social policies associated with the protection and use of forest resources that might aid in the transitions of the region's industries and communities;
- economic and social benefits from the ecological services you consider;
- regional, national, and international effects as they relate to timber supply, wood product prices, and other key economic and social variables.

As well, when locating reserves, your assessment also should consider both the benefits to the whole array of forest values and the potential cost to rural communities.

The impact of protection and recovery of threatened and endangered species on non-federal lands within the region of concern should be minimized. However, you should note specific non-federal contributions that are essential to or could significantly help accomplish the conservation and timber supply objectives of your assessment.

In addition, your assessment should include suggestions for adaptive management that would identify high priority inventory, research and monitoring needed to assess success over time, and essential or allowable modifications in approach as new information becomes available. You should also suggest a mechanism for a coordinated inter-agency approach to the needed assessments, monitoring, and research as well as any changes needed in decision-making procedures required to support adaptive management.

You should carefully examine silvicultural management of forest stands -- particularly young stands - especially in the context of adaptive management. The use of silviculture to achieve those ends, or tests of silviculture, should be judged in an ecosystem context and not solely on the basis of single species or several species response.

Your conservation and management assessment should cover those lands managed by the Forest Service, the Bureau of Land Management, and the National Park Service that are within the current range of the northern spotted owl, drawing as you have on personnel from those agencies and assistance from the Fish and Wildlife Service, the National Marine

Fisheries Service and the Environmental Protection Agency. To achieve similar treatment on all federal lands involved here, you should apply the "viability standard" to the BLM lands.

In addressing biological diversity you should not limit your consideration to any one species and, to the extent possible, you should develop alternatives for long-term management that meet the following objectives:

- maintenance and/or restoration of habitat conditions for the northern spotted owl and the marbled murrelet that will provide for viability of each species -- for the owl, well distributed along its current range on federal lands, and for the murrelet so far as nesting habitat is concerned;
- maintenance and/or restoration of habitat conditions to support viable populations, well-distributed across their current ranges, of species known (or reasonably expected) to be associated with old-growth forest conditions;
- maintenance and/or restoration of spawning and rearing habitat on Forest Service, Bureau of Land Management, and National Park Service lands to support recovery and maintenance of viable populations of anadromous fish species and stocks and other fish species and stocks considered "sensitive" or "at risk" by land management agencies, or listed under the Endangered Species Act; and,
- maintenance and/or creation of a connected or interactive old-growth forest ecosystem on the federal lands within the region under consideration.

Your assessment should include alternatives that range from a medium to a very high probability of insuring the viability of species. The analysis should include an assessment of current agency programs based on Forest Service plans (including the final draft recovery plan for the northern spotted owl) for the National Forests and the BLM's revised preferred alternative for its lands.

In your assessment, you should also carefully consider the suggestions for forest management from the recent Forest Conference in Portland. Although we know that it will be difficult to move beyond the possibilities considered in recent analysis, you should apply your most creative abilities to suggest policies that might move us forward on these difficult issues. You also should address shot-term timber sale possibilities as well as longer term options.

Finally, your assessment should be subject to peer review by appropriately credentialed reviewers.

## LABOR AND COMMUNITY ASSISTANCE WORKING GROUP

Resolving the forest management issues confronting this region must involve addressing related economic and community issues. The forests of the Pacific Northwest and northern California have provided a foundation for the region's economy for the past century. And, while economic growth has diversified a region that was once much more heavily dependent on timber manufacturing, some rural areas depend almost totally on forest industries not just for jobs but for revenues from timber sales. The work of the Labor and Community Assistance Working Group should proceed from the following:

- The economic development and assistance plan should be far-sighted and comprehensive. As noted at the Forest Conference, many species are at risk in old-growth forests. Just as the Ecosystem Management Assessment working group must focus on an ecosystem approach that takes into account the region's vast and varied natural resources, the economic plan must focus on the regional economy and take into account its resources and needs. The plan must be long-term and address not just temporary efforts but economic development and diversification over time.

- Government policy should accommodate properly functioning markets and facilitate the transitions inevitable in the modern global economy. The American economy is more dynamic that ever before. The federal government may be able to play a role in directing the development of the economy but it cannot overcome large-scale market forces. Economy policy here should encourage necessary adjustments and ease inevitable transitions.

- Some region-specific community and worker assistance will be necessary because of the unique circumstance surrounding this issue. However, the economic plan must be consistent with national policies. The Labor and Community Assistance working group should develop a comprehensive plan for economic dislocations whether those are caused by slack demand, productivity growth, technological advances, or structural changes in the economy. This approach would mark a dramatic improvement over the current patchwork of programs, which are both inefficient and inequitable.

- Any assistance plan should be open to all displaced forest industry workers, regardless of the precise cause of their dislocation. Revolutions in technology, improvements in productivity, and the development of new products are changing the nature of forest industries. We should reach out to all forest industries workers who are affected without distinguishing the cause of the impact.

- Policies should be coordinated among federal and state agencies to maximize benefits to affected communities and workers. More than a dozen federally-funded programs currently provide assistance to timber workers and their communities. A coordinated federal response would make the system more accessible and more efficient.

o State and local governments are best situated to direct economic development. Federal policy should not attempt to dictate preferred paths for economic development but instead should build upon the independence and strength of these communities and their residents and provide them with the tools needed for economic revitalization based on their own needs and on potential new opportunities in forest related employment.

## AGENCY COORDINATION WORKING GROUP

Too often in the past, various federal agencies with responsibility for some aspect of forest management in the Pacific Northwest and northern California have acted in isolation or even at cross-purposes. This problem becomes even more critical as we move toward an ecosystem approach to forest management where a number of agencies must be involved in planning and implementing a management strategy. We must improve the working relationships among federal and state agencies in the region and eliminate impediments that block coordinated action. The efforts of this working group are key to our success in this area.

To help identify new means to encourage coordination at all levels, we believe you should examine a range of issues.

Identify structural and procedural problems that in the past have made coordinated action difficult and suggest solutions or procedures for reaching solutions to those problems.

Identify ways the federal land management agencies can and should work together in the future to achieve coordinated management strategies that take into account the statutory mandates of those agencies.

Identify and suggest ways for dealing with issues concerning agency coordination related to implementing strategies currently being developed by the Ecosystem Management Assessment working group.

Identify ways to improve the process in which the land management agencies are required to consult with the Fish and Wildlife Service and the National Marine Fisheries Service concerning their responsibilities under the Endangered Species Act.

Identify ways to improve coordination between the land management agencies and the Environmental Protection Agency.

And, identify ways to improve working relationships between federal and state agencies in the region and suggest a course of action for involving those state agencies in the implementation of strategies being developed by the Ecosystem Management Assessment working group.

As you develop your recommendations, you should continue to call on personnel from the Forest Service, the Bureau of Land Management, the Fish and Wildlife Service, the National Marine Fisheries Service, the Environmental Protection Agency, and others as appropriate, as well as on advice from the states in the region.

## CONCLUSION

We appreciate your efforts and recognize, as President Clinton did, that these are difficult issues with difficult choices. And, we'll remind you of something else the President said at the Forest Conference, talking to the people of the Pacific Northwest and northern California: "We're here to begin a process that will help ensure that you will be able to work together in your communities for the good of your businesses, your jobs, and your natural environment. The process we (have begun) will not be easy. Its outcome cannot possibly make everyone happy. Perhaps it won't make anyone completely happy. But the worst thing we can do is nothing."

##

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
WASHINGTON, D.C. 20503

TO: David Cottingham
Office of Environmental Policy

FROM: Dinah Bear
General Counsel

Dinah Bear

DATE: June 21, 1993

RE: Supplemental Environmental Impact Statement for Management Standards and Guidelines for Old-Growth Related Species within the Range of the Northern Spotted Owl

In your discussions with the interagency team which is preparing the above-referenced supplemental environmental impact statement (SEIS), several questions have arisen in regards to the appropriate procedures to be followed under the National Environmental Policy Act (NEPA). This memo sets forth CEQ's understanding of those questions and our views on the matters raised.

First, we understand that the Forest Service and Bureau of Land Management, acting as joint lead agencies pursuant to 40 CFR 1501.5(b), are preparing a supplemental environmental impact statement (SEIS) on the options being developed by the Ecosystem Management Assessment working group. This SEIS is to supplement the Forest Service Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests (January 1992) and the Bureau of Land Management Draft Environmental Impact Statements for Resource Management Plans for the Coos Bay, Eugene, Medford, Roseburg, and Salem districts and the Klamath Falls Resource Area of the Lakeview District in Oregon, and Final Environmental Impact Statements for the Resource Management Plans for the Arcata and Redding Resource Areas of the Ukiah District in California. The SEIS will consider standards for maintenance of viability of old-growth related vertebrate species within the range of the northern spotted owl for use in the Bureau of Land Management Resource and Management Plans and for amendments to Forest Service Regional Guides and Land and Resource Management Plans.

The first question posed regarding this EIS relates to the issue of scoping. The CEQ regulations require supplemental environmental impact statements to be prepared, circulated and filed in the same fashion as a draft and final statement, except that scoping is not necessary. 40 C.F.R. 1502.9(c) (4). Thus, scoping is not required as apart of the process for this SEIS. Of course, this assumes that the Forest Service and the Bureau of Land Management undertook scoping for the original EISs

Recycled Paper

which are being supplemented. Additionally, the President's Forest Conference of April 2, 1993, served as a forum for discussion of these issues. Following that Conference, the Ecosystem Management Assessment Working Group received and considered a number of letters from interested parties, and administration officials have met with numerous interested parties. These steps, plus the initial scoping, have served to adequately define the scope of the issues, potential effects, and appropriate analyses for this SEIS.

I also understand that the Forest Service and Bureau of Land Management have raised a question over preparation of the "no action" alternative, which is a required part of any EIS. 40CFR 1502.14 (d). In our opinion the "no action" alternative should consist of the "no action" alternative from the Forest Service Final Environmental Impact Statement on Management for the Northern Spotted Owl in the National Forests (January 1992), the "no action" alternatives from the Bureau of Land Management Draft Environmental Impact Statement for Resource Management Plans for the Coos Bay, Eugene, Medford, Rosenburg, and Salem districts and the Klamath Falls Resource Area of the Lakeview District in Oregon and the selected alternatives from the Final Environmental Impact Statements for the Resource Management Plans for the Arcata and Redding Resource Areas of the Ukiah District in California. Because these alternatives have already been published and made available the public, the SEIS need not reprint all the details of these alternatives. A summary of these alternatives in the SEIS, with reference to the underlying documents, is sufficient to constitute a "a no action" alternative for the SEIS. However, the underlying documents (in other words, the original EISs) must be made available to anyone who asks for them.

We understand that comparison of the alternative in the SEIS with this summary "no action" alternative will be difficult, because most of the analysis underlying the various portions of the "no action" alternative were prepared are not fully comparable to the analyses prepared for the alternatives to be included in the SEIS. In addition, implementation of the "no action" alternative on Forest Service and Bureau of Land Management lands will not meet the requirements of the viability regulation. Therefore, a full discussion of the alternative is not necessary, as it does not constitute a reasonable alternative. 40CFR 1502.14(a).

However, to facilitate the decisionmaker's and the public's understanding of the various alternatives, and the ability to comment on them, a point of comparison for the alternatives is necessary. You have indicated that the Ecosystem Management Assessment working group report provides a proper basis for comparison. Option 7 is the most consistent with the current management of Forest Service and Bureau of Lands Management lands in the applicable area, and takes direction from the Designated Conservation Areas from the Final Draft of the Northern Spotted

Owl Recovery Plan applied to lands administered by the Forest Service and Bureau of Land Management. The matrix used is the 50-11-40 rule with modifications for the Bureau of Land Management. All other management elements would be subject to the following plans.

-Existing Forest Land and Resource Management Plans for the Pacific Northwest Region of the Forest Service.

-The preferred alternatives of the Draft Forest and Resource Management Plans for the Pacific Southwest Region of the Forest Service.

-The Revised Preferred Alternatives of the Bureau of Land Management Draft District Resource Management Plans/Environmental Impact Statements for Oregon.

You have suggested that the SEIS should compare, to the extent feasible, the "no action" alternative, described above as suitable, with the alternative representing Option 7, and then compare all other alternatives with the alternative representing Option 7. This two-step comparison process will provide a suitable benchmark for the decision-maker and the public to compare the effects of the alternatives. 40 CFR. 1502.14. This proposed use of Option 7 appears to be an appropriate means of comparing alternatives.

I hope this is helpful in addressing your questions regarding the application of NEPA and the CEQ regulations in this matter. We are available to help in the future, should further questions arise.

# Appendix D

## Related Direction and Activities

# Appendix D
# Related Direction and Activities

## INTRODUCTION

Appendix C of the Forest Service 1992 FEIS, which this document supplements, presents an overview of how other land managers and landowners are managing spotted owl habitat. Appendix E of the FEIS presents other related activities in progress at the national and state level that may affect how the Forest Service and BLM manage spotted owl habitat. The activities described in those two appendices are relevant to the alternatives presented in this Draft SEIS because management of habitat for the northern spotted owl is one of the primary objectives of this Draft SEIS, and because management of owl habitat is so closely related to management of habitat for other late-successional and old-growth related species. Therefore, some portions of those two appendices have been updated and rewritten as follows.

## FEDERAL

### Legislation

None of the bills described in the FEIS that addressed issues related to this environmental impact statement were signed into law.

### Recovery Plan for the Northern Spotted Owl - USDI

In December 1992, the U.S. Department of the Interior Northern Spotted Owl Recovery Team completed a Final Draft *of* The Northern Spotted Owl Recovery Plan (USDI 1992a). Recovery plans, as called for in the Endangered Species Act, set recovery goals and recommend management actions necessary for the recovery of federally listed species. As of July 16, 1993, the Recovery Plan had not been signed because the recovery strategy for Federal lands is so closely related to the efforts of the Forest Ecosystem Management Assessment Team (FEMAT).

A limited distribution of the Final Draft was made early in 1993, and the standards and guidelines for Federal lands from that document are included in this Draft SEIS in Appendix B, Recovery Plan Standards and Guidelines.

### National Park Service

The northern spotted owl is known to occur in eight National Parks including North Cascades, Mount Rainier, and Olympic National Parks in Washington; Crater Lake National Park and Oregon Caves National Monument in Oregon; and Redwood, Point Reyes, and Muir Woods National Parks in California. Spotted owls may also occupy the Whiskeytown National Recreation Area because spotted owls are known to occur in that region of California. National Parks within the range of the northern spotted owl may contain as much as 570,000 acres of nesting, roosting, and foraging habitat. Estimates are currently being refined as inventories of old-growth forests are completed.

Generally, the management objectives for National Parks are considered compatible with maintaining spotted owl habitat. National Park Service policy states that, "Natural resources will be managed with a concern for fundamental ecological processes as well as for individual species and features. Managers and resource specialists will not attempt solely to preserve individual species (except threatened or endangered species) or individual natural processes; rather, they will try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and ecological integrity of the plants and animals" (USDI 1988).

The emphasis on maintaining ecological processes as opposed to particular biological states may be relevant to managing spotted owl habitat, especially in the large Parks. Natural fires are recognized as a force that often drives processes of plant succession and they are therefore to be perpetuated in the Parks (USDI 1988). Historically, fires in Parks containing spotted owls ranged from frequent, low intensity, surface fires to infrequent, stand-replacing crown fires (Henderson et al. 1989, as cited in Thomas et al. 1990). The effects of surface fires on spotted owl habitat are poorly understood; crown fires, however, clearly reduce habitat. The amount of nesting, roosting, and foraging habitat in National Parks can thus be expected to vary over time, to the extent that natural disturbances are allowed to operate. Over long periods of time, maintaining mosaics of different-aged forest communities in Parks (which differ in amount of fuel and susceptibility to burning) may be an important means of reducing the probability of catastrophic fires (for example, Romme and Despain 1989, as cited in Thomas et al. 1990).

The National Park Service is currently surveying for spotted owls in Washington, Oregon and California. While no data is available for the Crater Lake National Park in Oregon, low intensity surveys have been completed and additional surveys are planned for 1993. Approximately 10 percent (33,000 acres) of the Olympic National Park in Washington was systematically surveyed as of 1993. California surveys have varied from none in some years to only low intensity surveys in others; no information was compiled in 1992. In 1993, the National Park Service expanded its survey program to one comparable to that of the Forest Service. In the future, the National Parks Service will be surveying many more National Parks within the range of the northern spotted owl.

## Fort Lewis Military Reservation

Located south of Tacoma, Washington, the Fort Lewis Military Reservation includes about 68,000 acres of contiguous forest, generally between 50 and 70 years old. Current management plans call for multiaged forests on approximately 43,000 acres. Some lands will be left in an unmanaged condition but no estimate of acreage is currently available. The nearest known spotted owl pair is located about 15 miles southeast of the reservation on the Gifford Pinchot National Forest. To date, surveys have not located northern spotted owls on the Fort Lewis Military Reservation.

## Indian Tribal Lands

Lands of the Quinault, Makah, Yakima, Confederated Tribes of Warm Springs, Confederated Tribes of Grande Ronde, Siletz, Hoopa, and Round Valley Tribes contain large acreages of forest. Much of this area has been designated for timber production; harvest methods vary from clearcutting to selective harvest. The number of northern spotted owls and amount of nesting, roosting, and foraging habitat is currently being determined through project analysis and Geographic Information System mapping. Specific funding has been allocated for spotted owl habitat management.

In Washington, the Quinault Tribe is consolidating older forest lands in and around the reservation. Habitat classification and spotted owl surveys are currently underway in these areas. The Yakima Tribe has managed all their lands under a selective harvest schedule for the past 40 years. Numerous owl pairs have reproduced in these managed areas. The Yakima Tribe also funds radio-telemetry research on spotted owl use in various forest types and complements these investigations with an active banding program. Many of the small reservations in the Puget Sound area of Washington contain managed forests. These areas have not been habitat typed, and it is assumed there are no spotted owls in these second-growth stands (J. Renwald pers. comm.).

In Oregon, lands belonging to three tribes fall within the range of the northern spotted owl. The Grand Ronde Tribe in the western Oregon Coast Range has 9,800 acres of forest that has been subject to timber harvest. Northern spotted owls are occupying both younger and older forests averaging no more than 80 years old. About 1,000 acres of these forests are classified as nesting, roosting, and foraging habitat. The Siletz Tribe has numerous scattered parcels of older forest between 80 and 120 years old; however, surveys have found no spotted owls occupying these sites. The Confederated Tribes of Warm Springs in the eastern Cascades has 311,000 acres of commercial forest land ranging from seedlings to old-growth stands. Currently, there are 26,000 acres of nesting, roosting, and foraging habitat. Most of the suitable habitat for spotted owls is in a mixed-conifer zone on the west edge of the reservation. Intensive habitat inventory and an owl banding program have been underway since 1991 to determine the impacts of both timber harvest and silvicultural practices on spotted owl habitat development.

In California, the Hoopa Tribe has classified over 25,000 acres of spotted owl nesting, roosting, and foraging habitat. Banding studies were started in 1992 to determine habitat use, dispersal and pair survival. The Round Valley Tribe has not classified any habitat to date although it is estimated that about 8,000 acres of commercial forest lands may offer some habitat elements.

# WASHINGTON CURRENT SITUATION

The State has a timber relief package for workers and communities affected by declines in harvest levels on Federal lands. The package provides training, including self-employment training, and conducts worker employment and career orientation programs.

## Washington Department of Wildlife

The Washington Department of Wildlife manages the Colockum Wildlife Area where a nesting pair of northern spotted owls was recorded in 1992.

## Washington State Parks

Washington State Parks manages several widely scattered, forested parcels within the range of the northern spotted owl. No standing timber over 10 inches in dbh is harvested unless it conflicts with use of roads, trails, or campground facilities. Of particular importance to spotted owl habitat are Beacon Rock State Park (4,500 acres), located along the Columbia River near Stevenson; Lake Easton (200 acres) and Olallie (540 acres) State Parks located along Interstate 90 in the central Cascade Range; Federation Forest State Park (600 acres of old-growth forest), located along the White River near Enumclaw; and Rockport State Park (600 acres of old-growth forest), located along the Skagit River in the North Cascades.

Other State parks that may be used for nesting, roosting or foraging habitat throughout the Cascade Range include the Skykomish Scenic River Designation Area (1,300 acres); Mount Pilchuck State Park (1,900 acres); Wallace Falls State Park (1,400 acres); Packwood State Park (200 acres); and Lake Wenatchee State Park (475 acres). These State Parks may provide important links among spotted owl habitat, and travel corridors for spotted owls.

## Private Lands

Approximately 78 spotted owl activity centers are currently known to occur on private lands in Washington. Nine of these are located on the Olympic Peninsula, 32 occur west of the Cascade Range, and approximately 31 are known to occur in the east Cascades (1992 Washington Department of Wildlife Interagency Spotted Owl Database, Olympia, Washington). A substantial portion of these sites were located in 1991 and 1992 when intensive surveys were initiated on many private lands. An additional number of spotted owl activity centers are located within 2 miles of private land in Washington, and spotted owls there likely use remaining older stands that might occur on these lands.

# WASHINGTON MANAGEMENT STATUS

The northern spotted owl is listed as an endangered species by the Washington Department of Wildlife. On June 26, 1992, the Forest Practices Board adopted changes to the forest practices rules via the Washington Department of Natural Resources policy statement memo, which supersedes the previous Owl Memo No. 3 of March 5, 1991. The modifications to the Washington Administrative Code on Class IV Critical Wildlife Habitats (State) and Critical Habitat (Federal) of threatened and endangered species address applications for harvest, road construction and pesticide use within 500 acres of a known spotted owl activity center. These proposed actions, now classified as "Special Forest Practices", would require a site-specific plan and consultation with various agencies, particularly the Washington Department of Wildlife.

Specifically, the regulations state, "This rule is intended to be interim and shall be changed as necessary upon completion of the Northern spotted owl recovery plan, rule making under the Federal Endangered Species Act, or other federal action, or other state actions," (WDNR 1992).

## City of Seattle

The Seattle Water Department currently manages about 68,000 acres of forest land, including approximately 3,000 acres of old-growth forest, in the Cedar River Watershed near North Bend, Washington. Current management provides for the establishment of a permanent reserve approximately 73,000 acres in size. The reserve will consist of old-growth forest, second-growth forest, and non-forested lands, and will make up 50 to 65 percent of the City's total ownership.

In addition, the Cedar River Watershed Land Exchange Act of 1992 directs the Forest Service to exchange with the City all remaining Federal land in the watershed (approximately 17,000 acres including part of a Habitat Conservation Area). The exchange is expected to occur within 2 to 7 years. Covenants on the exchange prohibit the City from harvesting timber within the HCA, or late-successional or old-growth forest in the watershed. The Federal land in the HCA and all Federal late-successional and old-growth forest will be added to the reserve.

Three single spotted owls and one pair have been located on intermingled lands within the watershed managed by the Mt. Baker-Snoqualmie National Forest and City of Seattle. The pair successfully reproduced during 1990 within the HCA.

# OREGON CURRENT SITUATION

Efforts have increased to assist individuals and communities who are affected by changes resulting from declines in harvest levels. Programs and services include extended unemployment benefits and supplemental benefits, skill assessment and retraining and a loan fund for beginning entrepreneurial ventures. Community assistance includes two loan programs to help businesses in timber-dependent communities and loans and grants for cities and counties to help existing and new businesses. To assist the wood products industry, the

1991 Oregon Legislature established a Wood Products Competitiveness Corporation to encourage and support cooperation among wood products firms, and to improve the level of technological expertise in the secondary forest products industry. The Oregon Forest Resources Institute was also created by the Legislature to enhance and support the State's forest products industry through public education, producer support and education.

## Oregon Department of Fish and Wildlife

Oregon Department of Fish and Wildlife currently maintains a depository for information on the spotted owl. Similar to Washington and California, Oregon's spotted owl data base is collected Statewide and is continually updated. The agency uses this information to track population gains and losses over time, assess management options, and assist them in their decision-making process.

## Oregon State Board of Forestry and State Land Board

The Oregon Department of Forestry manages 786,000 acres of forest lands in Oregon: 654,000 acres owned by the Oregon State Board of Forestry and 132,000 acres owned by the State Land Board. The State Land Board manages the South Slough Sanctuary near Coos Bay, which includes a 3,800 acre block of upland forest.

## Oregon State Parks

Currently, three pairs of owls have been located in Silver Creek Falls Park and one pair in the Van Duzer Forest corridor. Spotted owls have been sighted during surveys for Christmas birds near Cape Meares Park but none were found during the 1991 summer surveys. Additional surveys are planned in selected State Parks in 1993.

Although habitat for spotted owls is expected to increase on State Park lands in future years, few parks are expected to have enough nesting, roosting, and foraging habitat to support breeding pairs. Because of the wide distribution of park lands, some parks may support dispersing spotted owls or provide foraging habitat for owls nesting on adjacent Federal lands.

## Private Lands

Systematic surveys for spotted owls have not been done on most private lands, although some extensive surveys have occurred in association with Federal and State land surveys and research. Where Bureau of Land Management's checkerboard (intermingled ownerships) lands occur, limited surveys have been conducted on private lands. In demographic study areas, such as on the Bureau of Land Management's Roseburg District, nearly all private land has been surveyed. About 50 pairs of spotted owls have been located on private lands statewide in the last 5 years. As a result of public land surveys, additional pairs are known to exist on private lands.

# OREGON MANAGEMENT STATUS

The spotted owl is listed as threatened in Oregon by the Oregon Fish and Wildlife Commission. Under Oregon's regulations, this listing requires protection of the species and its habitat on State lands only; not private lands. All State agencies must consult with the Oregon Department of Fish and Wildlife when a project or action may affect a listed species. Forest management operations on State and private lands are governed by rules under the Oregon Forest Practices Act. The Oregon Forests Practices Act was amended in 1987 and requires that the Board of Forestry adopt rules to protect State-listed species or nest sites of sensitive birds. Interim rules have been adopted that require a written plan be approved by the State Forester when any forest operation is proposed within 300 feet of a nesting or roosting site of a listed species. Seventy acres of suitable habitat must be retained around a known spotted owl nest site or activity center.

# CALIFORNIA CURRENT SITUATION

In September 1992, the Simpson Timber Company's Owl Habitat Conservation Plan became the first industry plan to win approval from the U.S. Fish and Wildlife Service. Under direction from the Board of Forestry, the State is proceeding with the development of a Habitat Conservation Plan covering the entire range of the spotted owl in California on State and private lands. The plan is scheduled to be presented to the Board in the spring of 1993.

## California Department of Forestry and Fire Protection

Of the State forests within the range of the northern spotted owl, spotted owls are known to occupy seven nest sites in the Jackson State Forest while none have been reported in the Boggs Mountain or Ellen Pickett State Forests. Surveys in 1989 located three pairs and two single spotted owls at five sites in the Jackson State Forest. No spotted owl surveys have been done on the Ellen Pickett State Forest. The dry, inland pine forest type on the Boggs Mountain Forest is not known to regularly support spotted owls.

Both the Jackson and Boggs Mountain State Forests have active timber sale programs and are managed with the intent of providing a sustained yield of timber. At the Jackson State Forest, both clearcutting and selective cutting are used. Current quantities of forest in various age classes should remain relatively stable or show an increase in older, second-growth forest.

## California Lands Commission

The California State Lands Commission administers school lands in Del Norte, Humboldt, Mendocino, Lake, Sonoma, Siskiyou, Tahama, and Trinity Counties, all within the range of the northern spotted owl.

The commission is currently in the process of consolidating its school land holdings (township sections 16 and 36, or land selected in lieu thereof) located within lands managed by the Forest Service through land exchanges. When this process is completed, long-term forest management plans will be developed by the California Land Commission. The larger forest management units will include 15,000 acres in Mendocino County and 2,000 acres in Butte County. These parcels range in size from 40 to 3,600 acres. The parcels in the other counties range in size from 1 to 640 acres.

The data collected for the preparation of the Commission's forest management plans will include an inventory for the northern and California spotted owls. The northern spotted owl is known to occupy Oak-Bay (Quercus sp.) hardwood forests types in Lake, Sonoma, Napa, and lower Mendocino Counties.

Foresters from the State Lands Commission will continue to work with the California Department of Fish and Game environmental specialists to maintain the integrity of, and perpetuate, spotted owl habitat within the forested school lands within the commission's jurisdiction.

## Private Lands

The discussion of private lands on pages C-17 through C-18 of Appendix C of the FEIS, paragraph seven, is modified as follows to reflect new information provided by the landowners. Also, the Technical Advisory Committee was incorrectly identified in the FEIS, and should read "Timber Association of California." However, the reader is advised that the Timber Association of California no longer exists; it is now known as the California Forestry Association.

A segment of the timber industry in California conducted major surveys and inventory efforts in the last 3 years. Spotted owls were located at 318 sites on private lands; 163 of these sites had confirmed nesting pairs of owls.

In 1991, the U.S. Fish and Wildlife Service approved a habitat management plan developed by Sierra Pacific Industries, Inc. This plan, along with the Fish and Wildlife Service's conditions of concurrence, proposed a number of timber management practices to reduce the "likelihood of take situations". The approval for the Sierra Pacific Industries spotted owl management plan expired January 1, 1993, thus ensuring the incorporation of new information. As of April 1, 1993, the Sierra Pacific Industries spotted owl management plan has not been reapproved.

In September 1992, the Fish and Wildlife Service approved a habitat conservation plan submitted by the Simpson Timber Company (Blue Lake, CA). Simpson timber management practices include setting aside special management areas and call for changes in cutting areas. Similarly, in November 1992, the Fish and Wildlife Service approved a spotted owl habitat management plan developed by the Pacific Lumber Company. The Pacific Lumber Company Spotted Owl Management Plan was prepared as a management guide to insure no "take" situations.

### The Nature Conservancy

The Nature Conservancy owns two parcels of land with nesting, roosting, and foraging habitat within the range of the northern spotted owl in California. The Northern California Coast Range Preserve in northern Mendocino County contains about 6,500 acres of old-growth Douglas-fir forest in an 8,000 acre tract managed in about equal parts by the Nature Conservancy and Bureau of Land Management. The second area, the McCloud River Preserve in north-central Shasta County, contains 2,300 acres of forests, with about 1,600 acres in old-growth Douglas-fir and mixed-conifer stands considered nesting, roosting, and foraging habitat. Habitat in both areas is fairly contiguous along major watercourses.

Management direction for both areas is intended to preserve their natural qualities, including the continued maintenance of old-growth Douglas-fir forests. The Northern California Coast Range Preserve is managed by the University of California as a part of their Natural Reserve System and is part of a management agreement with the Bureau of Land Management. According to BLM's Resource Management Plan for the Arcata Planning Area, the agency will continue to manage this area as an Area of Critical Environmental Concern.

### National Audubon Society

The correct owner of the 1000-acre tract of second-growth redwood forest in coastal Marin County is the Audubon Canyon Ranch which is an autonomous, private, non-profit organization.

## CALIFORNIA MANAGEMENT STATUS

Since the U.S. Fish and Wildlife Service listed the northern spotted owl as a threatened species, the State of California has been managing northern spotted owl habitat on State and private lands to meet Fish and Wildlife Service guidelines (USDI 1990). For any proposed project, the landowner must submit for approval a Timber Harvest Plan.

In order to model habitat protection measures, the State of California uses Fish and Wildlife Service survey protocols to determine spotted owl presence and to protect habitat from take. Each Timber Harvest Plan is prepared by State licensed foresters and reviewed and approved by State biologists following Fish and Wildlife Service approved procedures. In addition to Timber Harvest Plans, a larger habitat protection plan called the Spotted Owl Resource Plan, which uses site-specific information to develop protection measures, allows harvest without "taking" spotted owls or diminishing habitat capability. The Spotted Owl Resource Plan necessarily involves more than one Timber Harvest Plan area.

The management strategy, taken from the California Forest Practice Rules (Title 14 CCR, 1991), for known nest sites or activity centers states, "Where a nest site or activity center has been located within the Timber Harvest Plan boundary or within 1.3 miles of that boundary, a Registered Professional Forester shall determine and document within the Timber Harvest Plan that the habitat described in [California Practice Rules] will be retained after the proposed operations are completed."

## BRITISH COLUMBIA, CANADA

The spotted owl is designated as endangered by the Committee on the Status of Endangered Wildlife in Canada. This means that spotted owls are believed to be threatened with imminent extirpation throughout all or a significant portion of their range in Canada.

Based on 1985-1992 field surveys, the entire Canadian population, estimated to be approximately 50 pairs, occurs in the southwest mainland of British Columbia. Two of 43 forest districts are affected. Twenty seven spotted owl activity sites (areas known to be inhabited regularly by spotted owls) have been recorded. Four are within existing parks and six are within the Greater Vancouver Water District lands. The remaining 17 are within the Fraser Timber Supply Area and the Soo Timber Supply Area and of these, eight fall within the Protected Areas Strategy study areas.

In 1990, a national Spotted Owl Recovery Team was appointed to develop a recovery plan. The Recovery Team is presently preparing recovery options for spotted owls in British Columbia that will span the scale from minimum to maximum protection. Each option will include a biological risk assessment and an associated economic impact evaluation. The recovery options are scheduled to be completed by October 31, 1993 and submitted to Cabinet. A national spotted owl recovery plan will be prepared and submitted to the Committee for the Recovery of Nationally Endangered Wildlife once Cabinet has selected an option.

Until Cabinet selects the preferred recovery option, government officials are working closely with forest industry representatives to maintain all conservation options. (von Sacken 1993)

# Appendix E

## Report of the Agency Coordination

# REPORT OF THE AGENCY COORDINATION WORKING GROUP

## I. OVERVIEW AND SUMMARY

There are many reasons for the gridlock that now exists with respect to the management of the federally-owned forests of the Pacific Northwest. Much of the problem is directly attributable to the lack of responsible leadership by previous Administrations, the adoption of policies that have drastically narrowed the decision space within which the Government must now operate, and the unrealistic expectations generated by those policies. In addition, part of the problem relates to the lack of coordination among the various federal agencies that are involved and to the sometimes inconsistent and inefficient procedures employed by them.

In part II of this report, we review some of the factors related to interagency workings that have contributed to the gridlock, including:

- lack of an agreed-upon shared mission;
- management incentives based on timber production;
- inability to adapt rapidly to change;
- inconsistent statutory mandates;
- technological constraints;
- structural problems with respect to agency budgets; and
- lack of trust -- between federal agencies and within individual agencies.

In part III, we describe our vision for the future -- a dramatically different way of fulfilling the federal agencies' responsibilities as stewards of the public lands. We begin with the premise that any option selected by the President will require vastly increased agency cooperation and coordination. This is inherent in the fact that the options involve an ecosystem management approach -- i.e., an approach that will not respect administrative or ownership boundaries.

Moreover, the ecosystem approach strongly suggests that the building blocks for planning should be watersheds and that the land planning units should ultimately be physiographic provinces or river basins consisting of a number of watersheds, rather than individual "forests" or "districts" (the units presently used by the Forest Service and the Bureau of Land Management). Because of this, we suggest a radically altered planning structure involving federal interagency teams, as well as participation by states, counties, tribes, and additional relevant parties.

Additional elements of our vision include:

- adoption of a more balanced approach with respect to commodity outputs;
- establishment of a revised process for consultation under the Endangered Species Act;
- establishment of an interagency Geographic Information System database;
- revision of the budget process;
- use of adaptive management based on monitoring and research; and
- alteration of incentives for agency personnel.

In part IV, we provide our recommendations for action. We begin with a detailed description of the four interagency groups that would form the primary structure for implementation of an ecosystem-based forest management strategy. We then describe the principal statutory and regulatory impediments to full achievement of that strategy.

We also describe, in general terms, the budget implications of our proposed changes. Preliminary review suggests that, during the interim period, when agencies are operating under the old system but also preparing to switch over to the new strategy (and when they are investing in a common database and related technology), agency budgets may need to be increased. In the long term, however, efficiencies and cost savings seem likely.

We caution against any expectation that agency budgets can be reduced commensurately with the decrease in timber harvest levels on federal lands, since the increased emphasis on objectives other than timber production (including recreation, species protection, rehabilitation, conservation, and other commodity production) will require the maintenance of adequate staffing levels.

The President, the courts, and the public have all challenged the land management agencies to meet multiple objectives. Timber cutting and road building will continue to decline, but it would be myopic for the agencies (and the Congress) to assume that the automatic results of that decline are reduced budgets and reduced staffing. The agencies must consider their broader mission and put forward the necessary programs of recreation enhancement and restoration of forests and watersheds (including research and monitoring) that will assure the health of the forests and their long-term productivity and utility to the public.

The final section of part IV consists of a listing of the specific actions to be undertaken, including:

- actions needed to resume the timber sale program;
- actions consistent with existing agency plans that would be taken during the development of new plans;
- actions necessary to develop new watershed-based plans; and

- actions to implement those plans.

In general, our report should be regarded as (1) a call for change, and (2) a vision of the future framework. Specific elements of that framework (and specific recommendations concerning process or procedural modifications) are subject to refinement or alteration as we begin to implement the new ecosystem management strategy.

The structural changes that we propose are based upon the specific physiographic situation addressed by the Forest Ecosystem Management Assessment Team -- i.e., the portions of Oregon, Washington, and northern California that are within the range of the northern spotted owl. Because our implementation approach includes consideration of fish species whose range is broader than that of the owl, it is possible that our proposed framework should be applied to the full range of those fish species. In addition, it seems likely that the concept of an interagency database and some other structural aspects of our proposal could be models for use in other geographic areas as well. However, our recommendations are focused on the geographic area covered by the ecosystem management options that are being developed, and we leave to others the question of whether (and when) our approach should be applied to other geographic areas.

# II. CURRENT SITUATION

## A. Forest Conference

On April 2, 1993, President Clinton held a forest conference to discuss how to break the gridlock over federal forest management in the Pacific Northwest. While the northern spotted owl emerged as the symbol of the controversy, the debate extended far beyond the issue of "owls vs. jobs." The President rejected the "either/or" proposition that a choice must be made between jobs and the environment. He challenged federal agencies to pull together to develop: (1) a balanced and comprehensive strategy for the conservation and management of forest ecosystems, while maximizing economic and social benefits from the forests; (2) a program for dealing with the effects of that strategy on communities and individuals; and (3) a plan to achieve better coordination and cooperation among the federal agencies that are involved in forest management issues.

Three groups were established to lead efforts to meet this challenge: the Forest Ecosystem Management Assessment Team; the Labor and Community Assistance Working Group; and the Agency Coordination Working Group.

This paper constitutes the report of the Agency Coordination Working Group.[1] Much of the report addresses the implementation of the strategy that is being developed by the Forest Ecosystem Management Assessment Team. The report rests on the premise that interagency cooperation will be a critical factor, not only with respect to the planning of a new ecosystem management strategy, but also with respect to the implementation of any such strategy. We believe that bold changes to the existing system -- including a dramatically increased level of cooperation among federal agencies -- are required, if we are to learn from past mistakes and avoid any further "train wrecks."

---

[1] The group includes representatives of the U.S. Forest Service (FS), the Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS), and the Environmental Protection Agency (EPA). A list of members is appended as Attachment 1.

## B. Factors Contributing to the Gridlock

A first step in solving the gridlock is to review the various factors that contributed to it. Focusing on agency coordination and process, among the more significant factors that have contributed to the current gridlock are the following:

- **The lack of agreed-upon common goals for management of federal forest lands in the Pacific Northwest.**

  Land ownership patterns sometimes result in adjacent federal lands being managed by two separate agencies, the Forest Service (FS) and the Bureau of Land Management (BLM). These agencies have sometimes operated pursuant to different management objectives and philosophies. This has resulted in inefficiencies and inconsistencies, as well as confusion on the part of the public.

- **A past emphasis on commodity production and the inability of federal agencies to adapt quickly to changing societal views regarding environmental** issues.

  The historical emphasis on commodity production (outputs) has resulted, over time, in a significant reduction of the old growth forest areas and the consequent reduction of the habitat of species closely associated with old growth, such as the northern spotted owl. This situation, combined with the depletion of old growth on private lands, has placed additional pressure for preservation of old growth on federal lands.

  In addition, damage to streams has contributed to putting many fish species at risk. The listing of these species as threatened or endangered under the Endangered Species Act (ESA), and resulting actions that have been viewed by some as too little and others as too much, have inflamed both environmentalists and loggers and have unquestionably contributed to the stalemate inherited by the Clinton Administration. Ultimately, the current gridlock resulted from the failure of previous Administrations to recognize and respond to the shift in societal views regarding old growth forests and their associated non-commodity values.

- **Management incentives based on timber production.**

  A related problem concerns inappropriate management incentives. In the past, land managers (and agency budgets) have been rewarded for achieving targets based on timber volume. By contrast, little or no formal reward or incentive has existed to encourage individuals or agencies to work together in program formulation or management activities that attempt to achieve multiple objectives, including conservation.

- **Court rulings concluding that agencies have not complied with statutory mandates.**

  In recent years, courts have reviewed several agency decisions relating to the management of old growth forest areas. In some cases, they have issued injunctions, requiring agencies to revisit earlier decisions and/or to take other specific actions above and beyond planned activities. Agency resources have been diverted from ongoing pursuits in order to respond to litigation demands, straining agency budgets and diminishing their ability to deal with other responsibilities. Among the more significant lawsuits and court rulings are the following:

  - A suit was filed in 1988, challenging the decision of the Fish and Wildlife Service (FWS) not to list the northern spotted owl under the ESA. The court ordered FWS to reconsider its decision and, as a result, the agency proposed the listing of the spotted owl as a threatened species.

  - In another major suit, conservation groups alleged that BLM had not adequately analyzed the impacts of proposed logging activities, thereby violating the National Environmental Policy Act (NEPA). This suit resulted in a 1992 injunction on all timber sales from BLM lands until BLM submits an adequate NEPA document that reflects new information relating to the impact of logging on the northern spotted owl.

  - A third major suit involved a challenge to the adequacy of the FS's regional management plan for the spotted owl. The court has issued injunctions blocking timber sales and has ordered the FS to develop and implement a revised management plan covering the spotted owl by December 1993.

  - In 1992, a lawsuit was filed challenging the decision of the Endangered Species Act Committee (often referred to as the "God Squad") to exempt certain BLM timber sales from ESA requirements. The plaintiffs alleged that the White House illegally pressured the God Squad to exempt sales. In February 1993, the Ninth Circuit ruled that the decision would be illegal if such pressure were proven, and it ordered further inquiry into the matter. The proposed exemptions were recently withdrawn.

  - BLM is also enjoined as a result of a court ruling requiring completion of Section 7 consultation on any spotted owl conservation strategy that is intended to establish criteria under which timber sale sites are selected in spotted owl habitat.

- **Problems associated with rapidly evolving information and requirements.**

  Federal land management agencies have had difficulty in demonstrating compliance with planning and environmental statutes in view of rapidly evolving information regarding forest ecosystems and the complexity of the current planning process utilized by the agencies. Often, a plan is vulnerable to challenge for not having considered information that was discovered after the plan was prepared. Moreover, changing requirements (such as those brought on by the listing of additional species) have challenged the ability of land management agencies to respond.

- **Inconsistent statutory mandates for different agencies.**

  Inconsistencies in the various land management statutes have impeded coordinated land management planning. For example, prior Administrations have assumed that the differences between the Oregon and California Revested Lands Act (O&C Act), governing some BLM lands, and the National Forest Management Act (NFMA), governing the FS, make establishment of consistent standards unattainable.

  Another example is that the land management agencies view legislative standards such as "jeopardy" and "adverse modification" under the ESA as standing in a somewhat confusing relationship to the NFMA standard of "viability."

- **Inefficiencies in the consultation process required under the ESA.**

  Under the current consultation process pursuant to the ESA, land management agencies complain that they often undertake a lengthy planning effort to conduct individual sales, only to receive a jeopardy ruling from FWS at the end of the process. The land management agencies contend that they receive inadequate guidance from FWS as to what is expected of them, while the FWS contends that the land management agencies sometimes fail to incorporate consideration of endangered species early in the planning process in accordance with their obligations under Section 7 of the ESA. Whatever the reason, the result is frustration on both sides.

  In addition, standards that FWS has used to determine jeopardy have shifted significantly during the planning processes in response to rapidly evolving information. Consequently, the land management agencies have had difficulty planning actions to avoid jeopardy.

- **Different data standards, technologies, and terminologies used by the various agencies.**

  The various land management and resource agencies have not typically worked together in developing information, nor have they developed compatible technologies. The lack of compatible databases impedes the sharing of information. In addition, the agencies have adopted different standards and different terminologies with respect to some issues, further impeding the agencies' ability easily to work together.

- **The existing budgetary structure, which discourages interagency cooperation and flexibility.**

  Federal agencies, especially BLM and FS, lack budget processes that allow the flexibility to meet ecosystem management challenges as they arise. The use of budget line items by program produces inherent intra-program conflict.

In addition, the current system for BLM and FS budgets restricts the ability of the agencies to engage in cooperative efforts that overlap agency boundaries. The present system ties targets to budgets and allows very little flexibility to adjust to changing conditions and needs in a timely manner (i.e., proposed changes are subject to a lengthy review and appeal process). This approach limits agencies' abilities both in their individual programs and in their ability to work with one another.

Moreover, as timber sales have declined, agency budgets have decreased, despite increasing demands on the agencies to deal with conservation, restoration, and other non-timber objectives. This further limits the agencies' ability to embark upon cooperative efforts. Another significant impediment is that FS and BLM are generally prohibited from using funds on lands not within their own jurisdiction.

- **Frustration with processes that seemingly lead nowhere.**

  People at various levels, both inside and outside of the government, are frustrated with the processes that have been followed in the past -- with meeting after meeting, report after report, and apparently unending delay in the accomplishment of any final result.

- **State and community frustration resulting from a lack of meaningful participation in the process.**

  The intensity of the current debate has been fueled by the general perception on the part of states and timber-dependent communities that they have been excluded from meaningful participation in the current BLM and FS planning processes. Many of those affected by agency decisions feel that their opportunity to be involved in the process is too little and too late.

- **Frustrations on the part of tribes.**

  The tribes feel that they have an important role to play in land management decisions, based on their treaty rights and their special relationship to the land -- especially their historic reliance on harvesting salmon and other fish species for subsistence and income-producing purposes. The failure of tribes to achieve desired results through the federal agency planning processes has resulted in frustration and ill-will.

- **Lack of trust between the public and federal agencies, as well as between federal agencies.**

  All of the factors outlined above have contributed to the pervasive lack of trust that exists between the citizenry and the government, as well as between the various federal agencies. A major contributing factor to the lack of understanding and trust among the federal agencies is conflicting agency mission and culture -- i.e., because the agencies pursue different missions and act pursuant to different statutory mandates, they sometimes disrupt the actions and strategies of other agencies, causing resentment and distrust.

Agencies also need to focus on the lack of trust that exists within an agency. For example, there is often distrust between research scientists and land managers, with researchers often believing that managers ignore their recommendations, and managers often feeling that scientists have moved into a management decision-making role by detailing prescriptive requirements focused on their relatively narrow scientific interests.

# III. VISION FOR THE FUTURE

The Agency Coordination Working Group was asked to identify ways to improve the working relationships among federal and state agencies in the Pacific Northwest and to recommend ways to eliminate impediments that block coordinated action.

Implementation of any option selected by the President will require interagency cooperation. Agencies must move away from their past tendency to act in isolation (and sometimes at cross-purposes) and their tendency to engage in turf battles. They must move toward the pursuit of uniform goals under a shared mission. Successful implementation of this strategy will require support at the highest levels of government. At the same time, involvement of "on-the-ground" personnel at all levels is also a critical ingredient. Only by pulling together can we break the gridlock and put into place a sensible and balanced approach to deal with land management issues into the future.

This section will outline some of the key components of the new forest management strategy. (Part IV will discuss, in more detail, the specific actions to be undertaken.) It must be emphasized that what we propose is an entirely new way of thinking and an entirely new way of doing business for federal land managers and regulatory agencies. The concepts set forth here are subject to refinement as planning evolves.

## A. Movement to an Ecosystem Focus

All agencies must support the initiatives that lie at the heart of the new forest management strategy, including:

- **A shift to an ecosystem approach.**

  All of the options being proposed by the Forest Ecosystem Management Assessment Team involve a new approach to land management -- an ecosystem-based approach that crosses jurisdictional boundaries. Ecosystem-based management will require a change of philosophy and a change in the way agencies do business. Increased agency cooperation and coordination must occur. Agreement on desired conditions and management objectives across the landscape is critical. Administrative boundaries and functional organization structures must not be allowed to impede achieving management goals on the ground.

- **Use of watershed analysis.**

  The report of the Forest Ecosystem Management Assessment Team recommends that land management decisions should be based on a different physiographic unit than under the current approach. Instead of formulating plans for individual forests or BLM districts, the Team recommends that future planning be based on watershed analysis, and that the planning units would ultimately be a number of watersheds, grouped into physiographic provinces or major river basins. The watershed-level analyses would be the building blocks for development of the province-level plans.

Watershed analysis will involve a preliminary assessment of existing and future impacts, based upon the review of known information. Many low risk decisions can and will be made on the basis of this analysis. Key watersheds, for which a more detailed assessment is required, will also be identified.

- **Drawing upon local community input.**

  Because much of the habitat for species at issue (particularly fish) is on non-federal lands, planning discussions for a watershed should include all landowners in the watershed (state, tribes, and private). There is a need to create an increased role for the local community in planning and decision-making in order to draw upon local expertise and to allow interested parties to participate in the process. Such participation will be more meaningful than under the past planning processes, since decision-making at the watershed level can be tailored to address local concerns.

- **Possible adjustment of boundaries.**

  In order to implement ecosystem-based management, administrative boundaries need to be reevaluated so that they make sense when developing watershed analyses and plans for physiographic provinces. Consideration should also be given to land exchanges, where appropriate, to maximize the agencies' ability to deal effectively with ecosystem management.

- **Adoption of a more balanced approach with respect to commodity outputs.**

  Land management agencies cannot maintain the high timber harvest levels established during prior Administrations, while also protecting wildlife, fish, and the ecosystems on which they depend. They should, instead, recognize the need for accommodation of both commodity outputs and ecosystem viability. A primary goal must be to maintain ecosystem health, including forest health (i.e., long-term sustainability). Existing incentives (based on timber production) should be replaced with incentives that will encourage both federal and nonfederal landowners to cooperate with one another and to support ecosystem-based management.

## B. Commitment to Improved Interagency Processes

If the new forest management strategy is to succeed, the key will be the interagency efforts that are undertaken to implement the strategy. Outlined below are some of the more important efforts to be undertaken.

- **The establishment of interagency groups to develop, monitor, and oversee implementation of land management plans (including groups at the province and regional levels).**

  Agencies must be brought together to discuss issues, clarify objectives, and work out solutions in a collaborative manner. Specific proposed interagency structures are described in part IV below. A brief overview is as follows:

  An interagency executive group would provide direction and oversight to implement ecosystem-based management through agency planning processes.

  A research and monitoring committee, comprised of research scientists from a variety of disciplines, would address issues of research and monitoring that are critical to adaptive management and to the long-term success of the effort.

  A permanent regional ecosystem office would provide a focal point for dealing with Section 7 consultation issues and for resolving regional consistency questions and issues related to plan development and other coordination issues. It would also evaluate major modifications arising out of the adaptive management process and coordinate the formulation and implementation of data standards.

  Provincial teams, consisting of representatives of federal agencies, states, tribes, and others, would develop analyses for particular watersheds and groups of watersheds.

  We should note that this interagency structure may present an opportunity for substantial linkages between the recommendations outlined in this report and those proposed by the Labor and Community Assistance Working Group. Portions of that group's proposed economic investment package for timber-dependent areas of the Pacific Northwest (which include new programs in environmental restoration and infrastructure) could be incorporated into the ecosystem-based management process that we describe.

  Additionally, many of the recommendations discussed in the "Implementation and Adaptive Management" section of the report of the Forest Ecosystem Management Assessment Team are similar to those presented in this report. Again, the processes and structures recommended here to facilitate movement to ecosystem-based land management plans seem applicable to accomplish the objectives of all three working groups. Further discussion of the potential for integrating portions of the work of the three groups needs to occur.

- **The establishment of a proactive, streamlined consultation process with FWS and NMFS, coupled with more responsiveness on the part of land management agencies to pre-listing recommendations, as part of an overall effort to minimize the likelihood of federal listing of species as threatened, endangered, or proposed.**

The existing consultation process should be revised to emphasize an integrated ecosystem approach. Participation of FWS and the NMFS early in the process is essential, so that the views of those agencies can be made known when the land management agencies begin to develop their plans for a particular area. Plans would build in management strategies to preclude the need for future listing of species when possible. Recovery planning objectives and critical habitat designations would also be built into plans where feasible.

In addition, programmatic consultations should be undertaken, where appropriate, in order to reduce costs and delays. Once a programmatic consultation is complete, subsequent agency actions determined to be in compliance with the broad plan may not need further formal consultation. For example, there should be no need for further formal consultations on individual timber sales (or other proposed actions), so long as those activities were sufficiently discussed within the programmatic consultation, are consistent with the approved plan, and minimize incidental take under Section 7.

The land management agencies need to be more responsive to the recommendations made by FWS and NMFS that are aimed at avoidance of further degradation of habitat. Moreover, even in the absence of specific guidance from FWS and NMFS, the FS and BLM must take seriously their responsibility under the ESA to act in a manner that obviates the need for listing.

Any additional regulatory or permitting requirements should be incorporated into the NEPA and planning processes as much as possible.

- **The establishment of an interagency Geographic Information System (GIS) database.**

Land management and resource agencies should coordinate their efforts in the collection and development of research and data. The Forest Ecosystem Management Assessment Team has taken a giant step toward that objective, assembling simplified interagency data for the forests of the region. The progress made by the ecosystem team should not be allowed to slip away. Rather, this effort needs to be taken to the next level of detail, with the establishment of an interagency GIS database, which will support implementation and monitoring. Given the crucial role to be played by the interagency GIS database, it is important to get it up and running as soon as possible.

It will also be necessary to establish consistent information standards and terminology between agencies. Cooperative efforts in support of this concept will result in efficiencies and cost savings in the compilation of research. In addition, the database would have the potential of improving and streamlining the NEPA and ESA analysis processes, as well as the permitting processes. Close linkages will need to be established between watershed, province, and regional efforts to define data standards and collect data.

Consideration should be given to how information from the states, private parties, and others could be included in the GIS and how (and on what terms) GIS database information could be made available to agencies or others outside of the federal government.

- **The establishment of a coordinated, flexible budget process.**

  The budget process will have to be dramatically revised in order to allow agencies to implement the new forest management strategy. Flexibility is needed to allow funds to be expended when and where needed to manage overall ecosystem health, including expenditures across jurisdictional lines and expenditures for joint projects such as the interagency GIS database.

- **Adjustment of agency processes.**

  Existing agency NEPA compliance and land use planning processes need to be changed to be simpler and more amenable to the constantly changing circumstances under which the agencies operate, as well as to facilitate interagency coordination. Consideration should be given to putting the new forest management strategy in place as a substitute for the current regional guide. The cumbersome FS plan amendment process is not conducive to an adaptive management approach and should be revised. Moreover, FS and BLM should adopt common planning cycles and should reconsider whether decadal planning cycles are appropriate. Another element to be incorporated into revised agency processes is increased opportunity for input by local communities, states, and other interested parties.

## C. Increased Adaptive Management Efforts

- **Evolution of ideas.**

  Ecosystem-based management is an evolving concept, and our knowledge relating thereto is far from complete. No one can predict all of the impacts that it will have, nor can we plan, at this juncture, how to address all of the developments that will take place as we implement the new forest management strategy. Accordingly, ecosystem-based management requires an adaptive management approach -- that is, an approach amenable to continual reevaluation and adjustments, based on actual on-the-ground results and new scientific information. Those involved in implementation must be willing to adapt to changing circumstances and to adopt improvements as they are identified. This will extend to all aspects of implementation (e.g., composition and functions of the interagency groups, adjustment of specific standards and guidelines, adjustment of boundaries).

- **Monitoring.**

  Monitoring will be an important part of the process. Throughout the implementation of the new ecosystem management strategy, actions should be monitored to ensure that they are being implemented as intended and to ensure that they are achieving the desired results. Gaps in knowledge should be identified (such as through the watershed analyses), allowing agencies to identify areas that require further analysis or study. It will be important to design a coordinated approach to monitoring (e.g., develop monitoring standards) during the early stages of implementation. Funding of this effort should be a high priority.

- **Learning.**

  The implementation of a new forest management strategy will be a dynamic and evolving process, subject to revision as improvements are identified. Federal land management agencies should be "learning" organizations -- i.e., they should enter the process recognizing that improvements may be made along the way. An integral part of this process includes the notion that federal agencies can learn from each other.

  Managers should be encouraged to learn from each decision by testing theories, evaluating results, and comparing anticipated results to actual outcomes. They should also follow through with the adoption of improvements as they are identified. Information should be openly shared between federal agencies. In addition, a mechanism should be developed to facilitate the transfer of research results and lessons learned from the adaptive management process to managers of non-federal lands.

- **Use of Adaptive Management Areas.**

  The application of adaptive management principles would most notably relate to the "adaptive management areas" established under one of the options being developed by the scientific team. These areas would be used for intensive ecological experimentation and social innovation, with the objective of developing and demonstrating integration of ecological and economic/social objectives. They provide opportunities for agencies, non-governmental organizations, local groups, and communities to work together to develop innovative management approaches.

## D. Agency Revitalization

- **Shared mission.**

  The current conflicts arising from the forest management issues have resulted in many agency employees losing their sense of mission in resource management. Overcoming this through the implementation of a new ecosystem-based approach will be welcomed by most employees. Common goals give professionals a sense of a shared mission of environmentally sound resource management.

- **Decentralization.**

  The Section 7 consultation process should be streamlined by providing a mechanism for receiving prompt decisions on policy matters and by delegating appropriate authority to the field or regional levels. All participants in the various working levels should be part of the decision-making process.

- **Personnel incentives.**

  The existing system of rewarding line managers for outputs must be replaced with a different reward system that takes into account other objectives.

Ecosystem-based management involves the pursuit of improved forest health. Pursuit of that goal, in and of itself, is a strong incentive for many. Agency recognition of the value of that objective, and elimination of explicit or implicit incentives to the contrary, will bind the agencies together in working toward the desired condition and strengthen intrinsic and professional satisfaction.

# IV. RECOMMENDATIONS FOR ACTION

The preceding two parts spell out some of the factors contributing to the current gridlock and describe a new mode of future operation. This part provides a detailed description of a coordinated agency approach to achieve this vision, including a discussion of:

- long-term interagency objectives and structures needed to facilitate the enhanced interagency cooperation;
- legislative and regulatory impediments to achieving the desired level of coordination;
- interim structures and procedures that will be required, while the new system is being put in place;
- proposed changes relating to budget and work force composition; and
- specific agency actions to be undertaken in connection with establishing the new structures and beginning to operate under the option chosen by the President.

## A. Long-Term Interagency Objectives and Structure

As indicated above, efficient future planning for the federal land in the Pacific Northwest involves a different approach (ecosystem-based), a different building block (watershed analysis), a different planning unit (physiographic province or major river basin), and vastly increased interagency coordination. The long-term structure for implementing the forest management strategy would consist of four interrelated groups -- an Interagency Executive Group; Provincial Teams; a Regional Ecosystem Office; and a Research and Monitoring Committee. Development of the specific missions of these teams will evolve over time, but our preliminary thinking (subject to further review based on, inter alia, the Federal Advisory Committee Act)[2] is as follows.

---

[2] The Federal Advisory Committee Act (FACA) imposes certain restraints on the workings of groups that include both federal and non-federal participants. In order fully to include non-federal entities in decision-making processes, we recommend asking Congress to declare the workings of these interagency teams exempt from FACA. A similar exemption was granted for recovery teams under the ESA, 16 U.S.C. Section 1533(f). Until such exemption is obtained, it may be necessary to limit participation in the interagency teams to federal representatives only and to involve others through existing cooperative processes, public hearings or meetings, and written comments. For purposes of this report, it is assumed that the FACA exemption will be obtained.

### (1) Interagency Executive Group

The Interagency Executive Group would be comprised of the Pacific Northwest federal agency heads of the FS, BLM, FWS, NMFS, National Park Service (NPS), and Environmental Protection Agency (EPA). This core group, which would guide planning for the federal lands in the region, would refine the desired ecosystem conditions and management objectives established by the Administration's plan to implement an ecosystem-based management strategy. It would translate and agree upon what the management objectives mean to each participant within the context of its own distinctive legal mandates and responsibilities. In appropriate situations, the core group would be expanded to include other federal agencies that have an interest in particular subjects that come before the group (e.g., Bureau of Indian Affairs, Corps of Engineers, Federal Energy Regulatory Commission, Bureau of Reclamation, Bonneville Power Administration).

The major role of the group would be to provide direction and oversight to implement the Administration's plan for the federal lands, with actual implementation being accomplished through province-level field teams. Among the functions of the Interagency Executive Group are:

- providing consistent direction to the provincial field teams, based on scientific recommendations;
- serving as a forum to share information and discuss major issues of concern that could have a significant impact on successful implementation (such as proposals for listing species, evaluation of the applicability of new scientific data, or evaluation of budget needs);
- approving research and monitoring priorities, as recommended by the research and monitoring committee;
- approving significant adaptive management proposals;
- providing interagency progress reports on plan implementation; and
- overseeing periodic evaluations of the process.

In addition to regular meetings of the Interagency Executive Group, formal quarterly meetings would be held with representatives of states, tribes, and others, during which major issues of concern to all parties would be addressed.

Working groups comprised of states and tribes (and private entities as appropriate) would be established to provide input regarding development and implementation of the Administration's plan for federal lands and to discuss the implications of plan objectives for non-federal lands. These working groups would provide advice and information to the federal agencies regarding their roles and responsibilities. Representatives of any of the working groups could be invited to participate in the Interagency Executive Group discussions if topics directly affecting that group were to be discussed. Ad hoc groups could be formed to address cross-jurisdictional issues (e.g., monitoring, research, guidance on ESA compliance).

The working groups would be active participants to ensure that all lands are considered in meeting desired ecosystem conditions and ecosystem-based management objectives.

Federal agencies should work with non-federal groups to encourage a similar team approach to ecosystem management for non-federal lands and to coordinate the strategy for federal lands with that for non-federal lands. This coordination should occur at all levels of the planning process in order to maximize overall benefits to society.

### (2) Provincial Teams

The federal land management agencies (BLM and FS) would ultimately be responsible for developing the management plans for lands for which they have been given statutory responsibility. However, they would work with provincial teams (composed of management and interdisciplinary staff from the FS, BLM, FWS, NPS, NMFS, EPA, states, tribes, and others, as needed) to prepare the federal land management plans for clusters of watersheds (physiographic provinces[3] or major river basins), based on the President's selected option. Actual composition of the teams would be dependent upon the land ownership pattern. Where it is agreed that permanent staff from a given agency or group is not necessary, that agency/group would provide appropriate staff on an as needed basis to work directly with provincial teams.

As indicated above, although the plans would be developed for federal lands, the provincial teams would have representation from the states in assessing related ecosystem problems and necessary actions for state and private lands in the watersheds. In this way, state and federal actions could be better integrated for maximum efficiency and environmental effectiveness. The development of coordinated (or joint) plans for non-federal lands at the state and local level would be encouraged.

In addition to the development of a provincial federal land management plan, the provincial planning process is intended to produce (concurrently) such other agreements or understandings as pre-listing conservation agreements between the FWS or NMFS and federal or non-federal land managers; anticipated timber harvest schedules on non-federal lands; and ESA Section 10 habitat conservation plans. The process is also intended to facilitate working with the states on Section 4(d) rules, for improved clarity and certainty under the "take" provisions of the ESA.

The teams would develop the land use plans consistent with the agreed-upon desired ecosystem conditions, management objectives, and legal mandates of the agencies. Based on specific provincial plan goals and desired ecosystem conditions, the teams would refine guidelines for

[3] In using the term "province," we are not endorsing any particular geographic configuration but are simply expressing a view that planning should be based on some configuration of relevant watersheds.

commonly occurring management activities (e.g., timber sales, recreational development, mining activities). Public participation would occur throughout the plan development and adaptive management process.

Section 7 consultation would result from the analysis of province-level conservation strategies and would be completed on a programmatic basis at the provincial plan level. The conservation strategies would include building in recovery objectives for listed species, eliminating/ modifying actions that might lead to jeopardy opinions for listed species, identifying critical habitat requirements (if needed), developing management strategies to preclude the need for future listings, and identifying priorities for restoration activities. The strategies would need to have sufficient specificity to assess the impacts of individual actions conducted under the provincial plan.

Consultations would emphasize an integrated ecosystem approach, to the extent feasible. Direct participation of FWS and NMFS throughout the analysis and planning process will help to ensure that plans are consistent with ESA requirements and that the subsequent Section 7 consultation process is streamlined.

If future actions are consistent with the province-level conservation strategies (on which a programmatic consultation has been performed), then further site-specific consultation will not generally be necessary. However, circumstances may require consultation at a sub-province level, e.g., watershed level, particularly when consulting on aquatic or riparian-dependent species.

Key watersheds, as identified in the provincial plan, would be prioritized for further detailed analysis after completion of the province-level plans. Actions could proceed following watershed analysis in accordance with the province-level plans. (Refer to Chapter V "Aquatic Ecosystem Assessment" of the Forest Ecosystem Management Assessment Team for a detailed description of the watershed analysis process.)

Essential tools for preparing provincial and watershed-level plans would be an interagency, unified GIS database, consistent information standards, common inventory methods, and well understood processes for information flows both horizontally and vertically.

The interagency provincial teams would be utilized in developing and implementing monitoring programs to ensure that actions are implemented as stated in the plans, effects are as anticipated, and actions are achieving the desired goals of the plans.

Monitoring is an important element of plan implementation, and it should be made a priority in terms of budget and staffing. Adaptive management actions would be identified as a result of monitoring and would be implemented as appropriate.

Inter-provincial coordination would also occur at the field level. Managers would be responsible for ensuring that field teams share information, monitoring results, and adaptive management approaches as necessary to accomplish overall ecosystem objectives. It is anticipated that most questions concerning consistency, new data implications, changes in regulations or requirements, and other such issues would be resolved at the provincial level, with few issues raised to the regional level.

### (3) Regional Ecosystem Office

A Regional Ecosystem Office reporting to the Interagency Executive Group would be established. This office would be comprised of a small, full-time staff that would draw heavily on field expertise and the research committee to analyze issues. Membership would include representatives from a variety of disciplines and institutions, including academia.

The office would also be responsible for defining the requirements for the GIS system, including establishing data needs, accuracy requirements, priorities, and the types of analysis that the system will be expected to perform. It would evaluate and resolve regional consistency questions and issues related to implementation of monitoring, Section 7 consultation, and other issues that could not be resolved at the provincial level. This office would also provide oversight to ensure that modifications arising out of the adaptive management process are evaluated and are consistent with ecosystem-based goals identified in provincial plans. Major consistency and policy issues would be forwarded to the Interagency Executive Group for resolution.

The office would provide a focal point for development and implementation of processes to ensure that watershed analyses are uniformly applied and that issues that cross provincial boundaries are integrated and consistent. Examples of such issues might include: GIS databases and data standards; format and data requirements for Section 7 biological assessments; and watershed analysis methodology.

### (4) Research and Monitoring Committee

The Research and Monitoring Committee would also report to the Interagency Executive Group. It would be comprised of research scientists representing a wide range of disciplines from the FS's Pacific Northwest Research Station, Pacific Southwest Research Station, National Biological Survey (NBS), universities, and states.

This Committee would: review and evaluate ongoing research (spotted owl, marbled murrelet and anadromous fish research, silvicultural practices, etc.); develop a plan of research designed to address critical natural resource commodity and non-commodity questions; and research biological, social, and economic adaptive management questions. It would develop scientifically credible, cost-efficient monitoring plans, with the assistance of the provincial field teams and Regional Ecosystem Office.

The Research and Monitoring Committee would prepare an annual report summarizing and interpreting results from monitoring and research activities. This report would include recommendations for changes needed to adapt existing management strategies to dynamic resource situations. Research priorities would be recommended to the Interagency Executive Group for approval.

## B. Legislative and Regulatory Impediments

Having identified the objectives to be pursued and the structures to be used to achieve our future vision, we need to determine whether those structures and objectives are feasible within the framework of existing law. In other words, is enlightened leadership and persistent attention to implementation sufficient to achieve the vision, or is there a need to change existing legislation or regulations?

- **Favorable Aspects Regarding Existing Laws and Regulations.**

  The existing situation, while in need of improvement, allows federal agencies a considerable range of management flexibility. Agencies frequently create interagency and interdisciplinary teams to deal with complex issues, some of which have been quite successful.

  Agencies also frequently combine financial resources to fund joint studies on wide ranging problems, much as the Interagency Scientific Committee provided the leaders of the FS, BLM, NPS, and FWS with the revolutionary proposals for conservation of the northern spotted owl.

- **Existing Legislative Impediments.**

  While we can learn from these examples, we propose much broader interagency cooperation, and we recognize that certain of our proposals will require legislative change.

  Nothing in the existing law would prevent the establishment of the interagency groups described above. However, some statutory provisions continue to stand as impediments to the full realization of the vision as spelled out in the previous section. The most important of these are the following:

  - There is widespread consensus that ecologically-based plans are essential to ecosystem management and that plans should be based on watersheds. The NFMA establishes individual national forests as the planning units and requires determination of sustained yield and allowable sale quantity on an administrative unit basis (17 forest plans in northern spotted owl habitat). In order to realize the potential of watershed-based plans in the most efficient manner, some changes to NFMA may be necessary.[4]

  - NFMA also constrains effective adaptive management by requiring the preparation of an EIS for revisions and significant amendments to plans. These time frames do not allow for prompt adaptation of plans to reflect evolving science or new policy.

  - There is a long-standing perception and tradition of funding agency employment and activity levels in an amount directly proportional to timber sales levels. (Annual appropriation bills

[4] The Department of Agriculture, while committed to this new approach to land management, believes that such revisions should be viewed in the context of a more comprehensive review and revision of this planning statute.

also provide funding for specific levels of non-commodity outputs, such as restoration of streams or rehabilitation of recreation sites and facilities.) The transition to an ecosystem planning and management process will require significant increased funding for monitoring and assessments, without the production of outputs in a manner commensurate with funding levels. If the new system of ecosystem management is to succeed, **for the next several years, relevant parties (including the Congress) will have to be persuaded that current or increased funding levels are appropriate, even though timber sales are below previous levels.** This is a critical issue, and one that must be recognized at the outset.

- Federal interagency planning and implementation should focus across the landscape and not arbitrarily stop at the existing boundary of a national forest or a BLM district, or at the boundary between the BLM administered O&C lands and other BLM administered public lands. It is desirable for the federal land managing agencies to have the flexibility to transfer, or perhaps to share, funding requirements for management activities on each other's lands. (Proposed revisions to the existing budget structure are discussed in more detail in section IV.D, infra.)

- Current law provides funds for administration of BLM and FS lands in northern California, Oregon, and Washington through several different appropriation accounts. While agencies may enter into administrative arrangements (such as reimbursable agreements) in order to pursue joint projects, they may not directly expend appropriated funds on other federal or non-federal lands within the same watershed. This should be reviewed and, we believe, changed. Further, while there are provisions for reprogramming funds between activities within an account, current procedures are complex and time-consuming. Additional attention is needed to develop improved procedures within the agencies and with the Congress.

- An ecosystem approach requires the protection of habitat for species without regard to whether the species has been listed under the ESA. The statutes applicable to the BLM lands should be clarified or changed (administratively or, if necessary, legislatively) to recognize that maintenance of species viability and habitat protection are important objectives on BLM lands, as well as FS lands. In many instances, this could prevent the decline of species populations to the point at which protection is necessary under the ESA. (However, it will be unlikely that, at least in the short term, the need to list some species will be eliminated.) This revised approach would also facilitate future federal land management, including timber sales, without the enormous uncertainty and conflict generated under current ESA procedures.

- **Existing Regulatory Impediments.**

Regulations promulgated by the agencies to implement current law are sometimes an additional barrier to realization of the future vision. There is no better example of the potential for reinventing government than the productivity and quality gains achievable by careful attention to review, revision, or elimination of a number of agency regulatory requirements. A number of these will be addressed as the agencies move to common standards and terminology for such tools as an interagency GIS approach. Others will naturally be modified when the underlying statutes are amended as suggested above. But others will only be identified and corrected if agency employees believe that change is called for and supported by the political leaders.

For example, the current review process for FS projects affecting owl habitat suggests opportunities for streamlining. FS projects concerning owl habitat conservation areas are subject to six internal review steps before being presented to the FWS for ESA Section 7 consultation. Projects outside of conservation areas but affecting owl habitat currently have a three-step review process before consultation even begins. It has been more than one and one-half years since any project removing wood products has made it through the simplest internal FS review and been presented to the FWS for consultation. The need for revision of this process is heightened by the increased workload that has arisen out of the increase in the volume of listings in recent years.

By comparison, FS uses a more efficient review process for species other than the spotted owl (and for Section 318 timber sales). In addition, BLM currently employs a more streamlined process in which biological evaluations are submitted to FWS after a general review at the state office level. BLM field biologists are encouraged to work directly with FWS staff as appropriate.

There are also some instances where changes in agency regulations could significantly improve agency operations. Substantial efficiencies would result, if a single administrative process could be used to satisfy the Environmental Impact Statement (EIS)/ Environmental Assessment (EA) requirements under NEPA and the Section 7 requirements under ESA. Further efficiencies are possible if the provincial plans are developed to satisfy the ESA requirements for recovery plan development and critical habitat designation.

Another example is that agency planning regulations currently require cumbersome, time-consuming processes to revise or amend the plans. It is important to pursue changes to streamline those processes during the transition to the ecosystem-based plans proposed in the long term.

## C. Interim Objectives and Structure

As soon as the President selects a preferred forest management strategy, it will be desirable to take certain steps relating to implementation, including the establishment of interagency groups and the development of the interagency GIS database. These efforts -- to be undertaken during the interim period prior to full implementation of the new forest management strategy -- are outlined below.

- **Beginning work on new plans.**

  Under the proposed process, for a period of time, agencies will be implementing the Administration's selected option through existing NEPA/planning processes. They will resume a timber sales program and continue other activities consistent with the existing land use plans but also reflecting the ecosystem strategy selected by the Administration.

  During this same time period, agencies will begin working on the watershed and province-level plans -- i.e., developing the watershed analyses at the same time they are still working with the existing plans.

- **Establishment of initial interagency teams.**

  Three of the four interagency groups described under the Long-Term Interagency Objectives and Structure section would be established in the near future in order to allow coordinated efforts relating to initial goals to begin:

  - The **Interagency Executive Group** would manage the transition process for watershed planning. A primary function of this group would be to ensure clear understanding and consistent implementation of the Administration's selected option by all federal agencies and at all levels within their organizations. The group would also provide the leadership and direction to initiate the steps to begin development of the province-level plans and to involve the states, tribes, and other relevant parties.

  - The **Regional Ecosystem Office** should also be established early on. This office would be comprised of scientists from the Forest Ecosystem Management Assessment Team and others as appropriate. Its initial priority would be to clarify and answer questions posed by all parties affected by implementation of the plan (such as FS/BLM field offices, states, industry, tribes, other federal agencies).

    Another priority of this group would be to define the requirements of a **unified GIS system**, including establishing data needs and standards, so as not to lose the momentum toward a common database that was established by the Forest Ecosystem Management Assessment Team.

  - The **Research and Monitoring Committee** would review and evaluate ongoing research and assist in the development of monitoring plans. At the request of the Regional Ecosystem Office, it would also evaluate (from a scientific perspective) any significant adaptive management proposals.

- **Analysis of possible legislative and regulatory revisions.**

  Appropriate legislative and regulatory changes discussed previously would also need to be considered in the interim period to provide the basis for moving toward ecosystem-based land management planning. By initiating this effort during the interim period, conflicts can be identified at the outset. Actions can then be taken to avoid or minimize those conflicts or, alternatively, efforts can be undertaken to revise existing statutes or regulations, as needed.

## D. Issues Related to Budget and Work Force Composition

Under ecosystem-based management, lands are managed as an integrated unit for long-term system viability. This approach has a significant impact on budgeting, organizational structures, and work force composition.

- **Integrated, Flexible Budget Process.**

If BLM and FS are to manage Pacific Northwest forests through an ecosystem approach, the current federal budget process will need to be changed. Under an ecosystem approach, timber will continue to be produced, but consideration will also be given to the need to promote a healthy forest system for all the plant and animal species dependent on it. Federal agencies, especially BLM and FS, need a budget process that will allow the flexibility to meet ecosystem management challenges as they arise.

Eliminating the constraints of budget line items by program (e.g., wildlife, timber, management, recreation) will reduce some of the inherent intra-program conflict that detracts from a holistic ecosystem management approach. Agencies must be able to concentrate dollar resources on problems and opportunities in geographic areas, regardless of ownership, where and when they arise and to encourage cooperation rather than competition between programs, offices, and agencies. In particular, FS and BLM budgets should be complementary to address areas and issues that overlap agency boundaries.

Although it is probably too late to alter, in any significant respect, the current BLM and FS substructuring within the FY94 President's budget, **language could be written into Congressional reports that would grant advanced approval to reprogramming between subactivities within the boundaries of the Administration's forest ecosystem plan.** Language of this nature would allow BLM and FS proportionately to adjust efforts in concert with overall appropriation increases or decreases. During FY94, this flexibility is critical to enable the federal agencies involved to address constantly changing and evolving issues and direction coming out of the President's forest conference.

- **Costs.**

Under the proposed process, two distinct phases are considered for this discussion. In the interim/transition period (within approximately the next 4 years), demands on agency staff will increase as the agencies operate in two modes concurrently. First, agencies will be implementing the Administration's selected option through existing NEPA/planning processes and providing timber sales to the extent consistent with the selected option. Specifically, for the timber program, agencies will be: conducting interdisciplinary analyses on sale areas; laying out, marking, cruising, and appraising sales; designing roads if required; preparing EAs; completing Section 7 consultations if necessary; completing marbled murrelet and owl protocols (2 years of surveys); and advertising and awarding sales.

During this same time period, agencies will be starting work on the province-level plans and initiating work in an interagency mode to accomplish tasks critical to developing ecosystem-based land management plans and EISs. Critical tasks will include establishment of interagency work groups to address cross-cutting issues such as: content and format of watershed analyses; development of GIS data standards; data acquisition and procurement of hardware and software; public involvement process; monitoring and research plan development; and programmatic consultation processes.

Interagency teams will also complete general watershed analyses and write the provincial plans once standardized consistent guidance has been developed.

The scattered land base drastically increases costs because of coordination with adjacent landowners and the procurement of resource data for private and state lands. If adequate data are not available on private land, BLM or FS may have to expend funds to collect data to develop ecosystem objectives.

Limited baseline resource data is presently available for most watersheds. This is particularly true for biological resources data. At present, very little information exists with respect to riparian habitat, channel morphology, mass soil movement, road conditions, and related subjects. Information that does exist has been collected using different agency standards and is often in a format that impedes analysis.

Because ecosystem-based management is a complex approach with many unknowns, the monitoring and research programs are critical and must be funded. In fact, monitoring and research are the cornerstones of the adaptive management process. Many of the monitoring and research efforts will relate to the adaptive management areas that will be established under the preferred strategy. There will also be expenses in connection with establishing the areas and coordinating public involvement. Developing innovative approaches to financing will be an essential element of the adaptive management area strategy.

In summary, agency staffing will certainly need to be maintained at current levels, and budgets will likely need to be increased in order to accomplish the identified tasks in the interim/transition period.

In the long term, the process proposed here should result in cost savings through more efficient utilization of staff and resources such as GIS data systems. Among the anticipated improvements are:

- Early and meaningful participation by the regulatory agencies and the public in the provincial planning process could potentially save millions of dollars by reducing the risk of litigation and the risk of changes in project-specific design (e.g., changes resulting from jeopardy determinations).

- Moving to provincial plans on a physiographic basis should reduce the overall number of land management plans and EISs produced by the FS and BLM.

- Programmatic consultations and building in management objectives to reduce the number of future listings and recovery planning for listed species should result in less time spent on individual consultations, listing analyses, and recovery plan preparation.

- With reduced timber sales, costs for purchase of seedlings and seeds and site preparation costs will decline. Efficiencies may be gained by utilizing existing nurseries and seed orchards on a joint area basis or possibly eliminating the need for some.

- The FS and BLM have more planning layers, more internal review layers, and more specific detailed regulatory requirements than required by law, and could no doubt simplify internal processes, while maintaining accountability to the public.

- Existing planning and environmental analysis processes could be streamlined with the amendment of the FS regional guides and elimination of BLM State Director guidance.

- With both agencies on the same planning cycle and working together as a team on one ecosystem-based plan for the province, efficiencies should result in better utilization of staff and savings with respect to such items as mapping and printing costs.

- Opportunities for joint programs and partnerships with a wide variety of groups also have the potential to accomplish considerably more than could be achieved by each entity on its own.

A detailed workload and budget analysis should be completed to attempt better to quantify budget and staffing requirements. It is important to realize, however, that a true ecosystem management approach requires an increased amount of coordination, collaboration and working with larger groups of concerned parties. More time will be needed for meaningful public involvement.

- **Organizational Structures and Skill Mixes.**

Implications for organization structures and work force skill mixes in the long-term are also important factors. Land managing agencies still have responsibility for the same number of acres of land; however, the management prescriptions on those lands will be quite different than in the past. The work force will need higher skill levels in: communication and team work; data analysis and manipulation; and interdisciplinary thinking but functional expertise. Certain skills only sporadically represented in existing organizations will need to be increased. These include ecologists, hydrologists, botanists, fisheries biologists, and social scientists, to name a few. Other skills may not be needed at the level in which they are currently represented in the work force. These might include road engineers, cruiser/appraisers, scalers, and forest development technicians.

Organization structures need to be evaluated to ensure that they do not impede ecosystem-based management. This should include a look at existing agency management jurisdictions, as well as internal administrative boundaries.

## E. Specific Actions To Be Undertaken

A series of actions must be undertaken in order to implement the desired strategy for the conservation and management of the forests in the Pacific Northwest.[5] While it would be difficult at this stage to identify all actions to be taken, some of the more significant items are listed below. We have attempted to group these actions into distinct categories and to arrange them in what is essentially a chronological order. However, as will become apparent, many of the actions identified can and will occur simultaneously.

### (1) Actions needed to resume a stable timber sale program.

An initial focus will be on identifying and carrying out actions to resume the timber sale program in compliance with the guidelines set forth in the selected option. Among the steps to be taken (regardless of which option is selected) are:

- **Preparation of the Supplemental Environmental Impact Statement (SEIS) on the range of alternatives developed by the Forest Ecosystem Management Assessment Team.**

  The SEIS will describe all the action alternatives and compare the effects of the alternatives in terms of the affected environment and environmental consequences, including the impact on the economy and communities, regional employment, government revenues, rural communities, and consequences for Native American peoples and cultures. It is currently anticipated that the draft SEIS will be published on July 16 and that the final SEIS will be completed before the end of the year.

- **Completion of regulatory requirements.**

  The agencies must complete appropriate Section 7 and other consultation on the range of options developed by the Forest Ecosystem Management Assessment Team.

---

[5] Another discussion of the steps involved in the implementation of the new forest management strategy is set forth in the "Implementation and Adaptive Management" chapter of the Forest Ecosystem Management Assessment Team report.

- **Lifting of injunctions.**

  The agencies will move as quickly as possible to have existing court injunctions lifted.

- **Amendment of existing plans.**

  FS and BLM will begin implementation of the selected option through their respective land use planning processes. This will include the automatic amendment of existing FS land use plans upon the completion of the Final SEIS. In addition, BLM will complete the Final Resource Management Plan (FRMP)/EISs, based upon the selected option in the Final SEIS.

- **Site-specific timber sale planning.**

  The agencies will also begin timber sale planning in a manner consistent with the selected option. As part of this effort, BLM will complete timber sale EAs, and FS will complete timber sale EAs and biological assessments.

- **Completion of regulatory requirements on the timber sale EAs.**

  In compliance with existing regulatory requirements, FS will need to submit biological assessments on timber sales for Section 7 consultation. FWS will need to confirm BLM's compliance with requirements resulting from programmatic consultation on FRMPs.

After the completion of the above steps, timber sales may be offered and awarded, subject to FS and BLM internal administrative appeals or court challenges.

### (2) Actions consistent with existing BLM and FS land use plans (to be taken prior to the implementation of provincial-level land use plans).

In the case of the FS, a substitution of physiographic provinces for national forests as the planning units may require statutory change, and the timing and implementation of that change will be in the hands of FS and Congress.[6] Until province-level plans have been put into place, BLM and FS will identify and carry out actions that are consistent with existing land use plans and that also reflect the selected option.

- **Preparation of site-specific activity plans.**

  FS and BLM will prepare site-specific activity plans consistent with the selected option (e.g., timber sales, wild and scenic river plans, fish and wildlife projects). This will include the completion of appropriate NEPA analysis and Section 7 consultation, with appropriate public involvement.

---

[6] All subsequent references to provincial plans are subject to this caveat. For discussion of possible statutory revision, see supra note 4 and related textual discussion.

- **Implementation of other actions.**

  Actions in conformance with plans that do not require further detailed analysis will be undertaken.

### (3) Actions necessary to establish new interagency teams and processes and to develop provincial plans.

To make the transition from the current land use planning process to the long term, many actions need to be undertaken. Some of these actions can and must occur concurrently in order to move forward in a reasonable time frame. These actions include:

- **Establishment of the Interagency Executive Group, the Regional Ecosystem Office, and the Research and Monitoring Committee.**

  Steps would be taken to establish the above groups in order to allow coordination efforts to get under way. In determining the membership of the groups, consideration should be given to the implications of the Federal Advisory Committee Act and the Appointments Clause of the Constitution.

- **Refinement of the components of the selected option.**

  Agencies will delineate the watershed and physiographic province boundaries and begin to apply the region-wide standards and guides.

- **Development of unified GIS database.**

  Steps to further the development of a unified GIS database will be undertaken, including: establishing data needs, standards, and priorities; agreeing upon standardized software and acquiring software and hardware; and acquiring data sets. Certain efforts preparatory to the creation of this database have already begun, as part of the work of the Forest Ecosystem Management Assessment Team. Interagency efforts should pick up where this team left off, without any break in time, so as not to lose momentum.

- **Watershed planning analysis.**

  The agencies will need to work together, and with the public, on the watershed analysis process as an initial step in the development of ecosystem-based plans for FS and BLM lands. Agencies must determine the content and data needs for initial watershed analysis and the need for provincial teams. Watershed assessments would then be completed, relying primarily on existing data. Key watersheds would be identified and prioritized for detailed analysis.

- **NEPA and other regulatory compliance.**

EISs on province-level plans will be prepared, with appropriate public involvement. Compliance with other regulatory requirements should be undertaken concurrently with NEPA compliance. This would include the completion of programmatic Section 7 consultation and working with the states on 4(d) rulemaking under ESA, if appropriate, to streamline authorization of incidental take on non-federal lands. To the extent applicable, the specification of recovery objectives for listed species, the identification of critical habitats, and the development of strategies to preclude future listings should also occur.

- **Monitoring plans and standards.**

  Another critical step is for the agencies to work together in developing scientifically credible monitoring plans. Monitoring standards and guidelines need to be developed to ensure that actions are implemented as stated, effects are as anticipated, and actions achieve the desired goals of the provincial plans.

- **Research plan.**

  The agencies must also develop a coordinated research plan. This plan will involve: the evaluation of ongoing research; the identification of biological, social, and economic adaptive management questions; and the recommendation of research priorities.

- **Public involvement.**

  The agencies must determine what process(es) should be followed to facilitate meaningful public involvement. They should focus on fulfilling requirements under NEPA/planning regulations and expanding participation to all players involved in an ecosystem approach to land management.

- **Ongoing review and evaluation of needed legislative, regulatory, and administrative changes.**

  One undertaking that should begin at the outset and continue throughout the implementation process is the review and analysis of current legislation, regulations, and policies -- for the purpose of identifying any changes necessary to implement ecosystem-based management. At the same time, efforts should be undertaken to simplify existing internal review procedures.

  With respect to legislation, at a minimum, the following matters should be assessed: (1) FS's ability to revise existing planning boundaries without amendment of NFMA;[7] (2) the focus in the O&C Act on timber production and the absence from that Act of specific authority to protect species, including an assessment of the relationship to the diversity/viability standard of NFMA (unless it is determined that this issue can be addressed administratively); and (3) restrictions that limit the ability of the FS and BLM to expend dollars outside of their own boundaries (restrictions that potentially hinder collaborative efforts).

---

[7] As previously noted, amendment of NFMA will probably await a more comprehensive review of the statute.

As for regulations/policy, the following items should be addressed to facilitate implementation of ecosystem-based management in the most cost-efficient manner. Planning processes must be consistent and need to shift to a watershed/provincial basis. The plan amendment process should be redesigned to accommodate changes resulting from the adaptive management process in a more timely manner. Section 7 consultation should be streamlined, with recovery plan requirements and critical habitat designation incorporated into the planning process where possible. The relationship between the viability standard and the "jeopardy" and "adverse modification" standards under ESA need to be clarified. Where appropriate, agencies are encouraged to delegate to the field level authority for regulatory compliance.

- **Revisions to budget process.**

  Another major undertaking will be: the development of an integrated, flexible budget process, including the elimination of functional subactivity line items; the concentration of dollar resources on problems and opportunities within geographic areas regardless of BLM or FS ownership; and the adoption of a flexible system to address evolving issues and changes in direction. An accountability system based on achievement of desired ecosystem condition (commodity and non-commodity features) should be developed to allow managers increased financial flexibility and incentives, including carry-over of unexpended funds from one fiscal year to the next. The desirability of establishing mechanisms to allow expenditure of appropriated funds on non-federal lands to achieve ecosystem objectives should be explored.

### (4) Actions to implement provincial-level land use plans

Once the province-level plans have been completed, on-the-ground activities can be implemented in conformance with these plans.

- **Actions that do not require further detailed analysis.**

  Based on the guidelines and strategies in the province-level plans, any actions consistent with the plans and not requiring further site-specific analysis can go forward.

- **Completion of detailed watershed analysis.**

  Detailed watershed analyses, involving inter-disciplinary teams of resource specialists, will be completed on key watersheds and elsewhere, as appropriate. These will be as prioritized through the province-level plans. The applicable NEPA analysis, Section 7 consultation, if necessary, and appropriate public involvement would be completed.

- **Adaptive management.**

  Throughout the implementation process, the agencies should identify adaptive management actions as a result of monitoring, research, new policies, legislation, and regulations. This will involve: reviewing and evaluating adaptive management proposals; integrating adaptive management proposals into agency planning processes; and periodically evaluating and adjusting research and monitoring plans.

# V. CONCLUSION

The President's selection of a new forest management strategy based on an ecosystem approach will present an enormous opportunity, while also presenting a difficult challenge.

The current forest management system does not reflect the shift that has occurred in the public will from a focus primarily on timber production to a focus on meeting multiple objectives and on the long-term health of the forests. The ecological requirements of the Endangered Species Act and the National Forest Management Act, when superimposed on administrative planning that emphasizes timber production and that is relatively inflexible and poorly coordinated among federal agencies, contributes to the gridlock situation in which we find ourselves today. The formulation of a new approach to forest management, with its new objectives, new sense of shared mission, revised planning units, and increased needs for coordination among federal agencies, provides an opportunity to review the elements of the present system that do not work and change them.

At the same time, we must acknowledge that the change will be difficult and that additional expense (within existing agency budgets) will be involved, at least in the short run. In the long run, efficiencies should be possible, and we expect further analysis to show that long-term costs will not increase significantly.

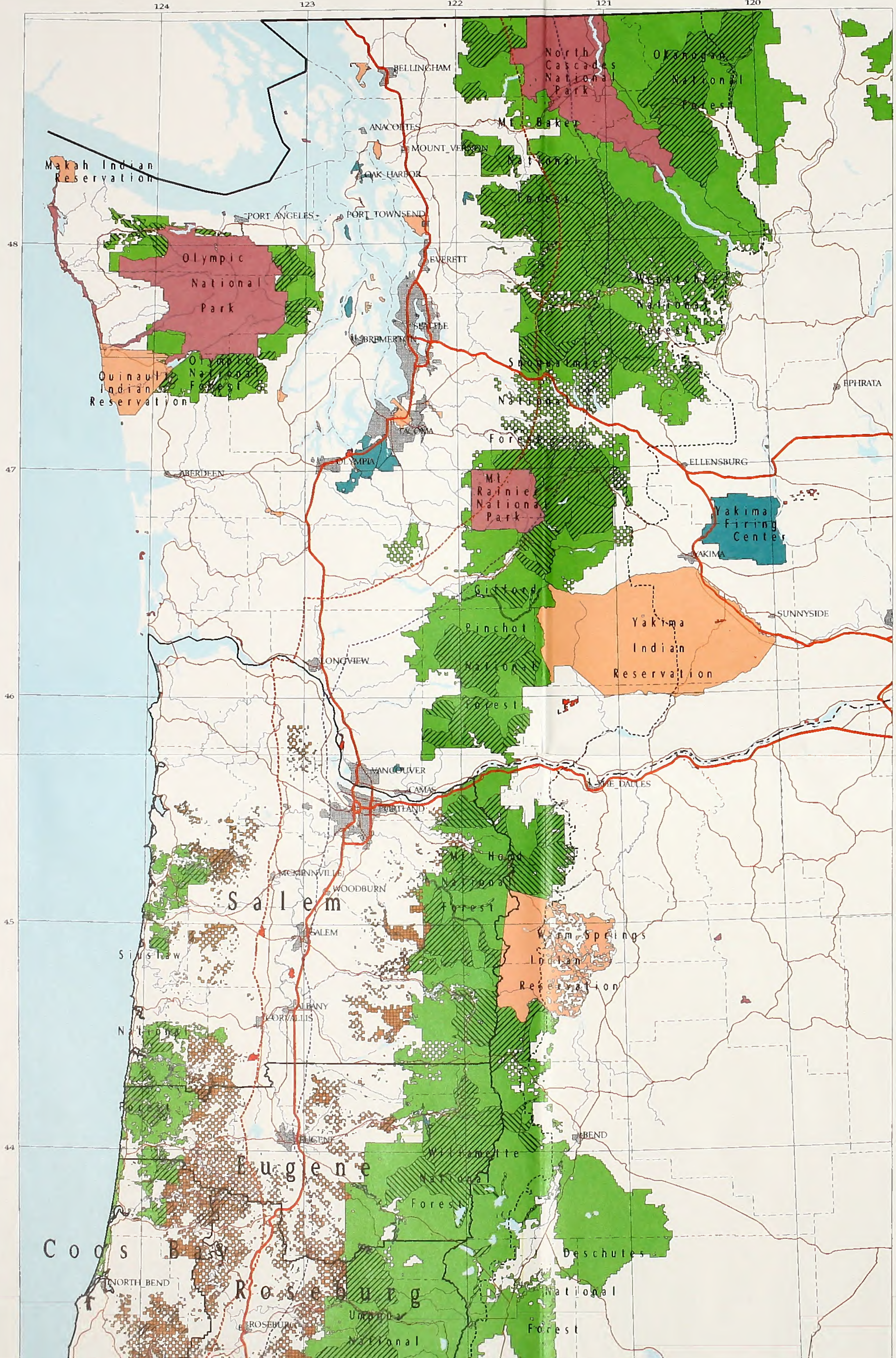
We believe that the changes set forth above will result in a system that works -- one that coordinates the actions of various federal agencies, brings non-federal parties into the process of regional land use planning, and balances ecological, economic, and social interests. It is time to move on.

Attachment 1

## Members of Agency Coordination Working Group

James Pipkin, Special Assistant and Counselor to the Secretary of the Interior, Working Group Leader
James Overbay, Deputy Chief, National Forest System, Forest Service, USDA
John Lowe, Regional Forester, Forest Service, USDA
Michael Penfold, Assistant Director, Lands and Renewable Resources, Bureau of Land Management, USDI
Elaine Zielinski, Deputy State Director, Lands and Renewable Resources, BLM, USDI
Michael Collopy, Director of BLM Coop Research Unit, USDI
Michael Spear, Assistant Director, Ecological Services, U.S. Fish and Wildlife Service (FWS), USDI
Dale Hall, Assistant Regional Director, Ecological Services, FWS, USDI
Barry Mulder, Project Manager for Forest Ecosystem Office, FWS
Nancy Foster, Acting Assistant Administrator for Fisheries, National Marine Fisheries Service (NMFS)
Rolland Schmitten, Director, NW Region, NMFS
Merritt Tuttle, Division Chief, Environmental and Technical Services, NMFS
Richard Sanderson, Director of the Office of Federal Activities, Environmental Protection Agency (EPA)
Anne Miller, Director, Federal Agency Liaison Division, EPA
Charles Findley, Director, Water Division, Region 10, EPA
Peter Raynor, Assistant Solicitor for Fish and Wildlife, USDI
Kris Clark, Assistant Solicitor for Land Use and Realty, USDI
Michael Gippert, Deputy Assistant General Counsel for Natural Resources Division, USDA

☆ U.S. GOVERNMENT PRINTING OFFICE: 1993—793-234 / 82403 REGION NO.10



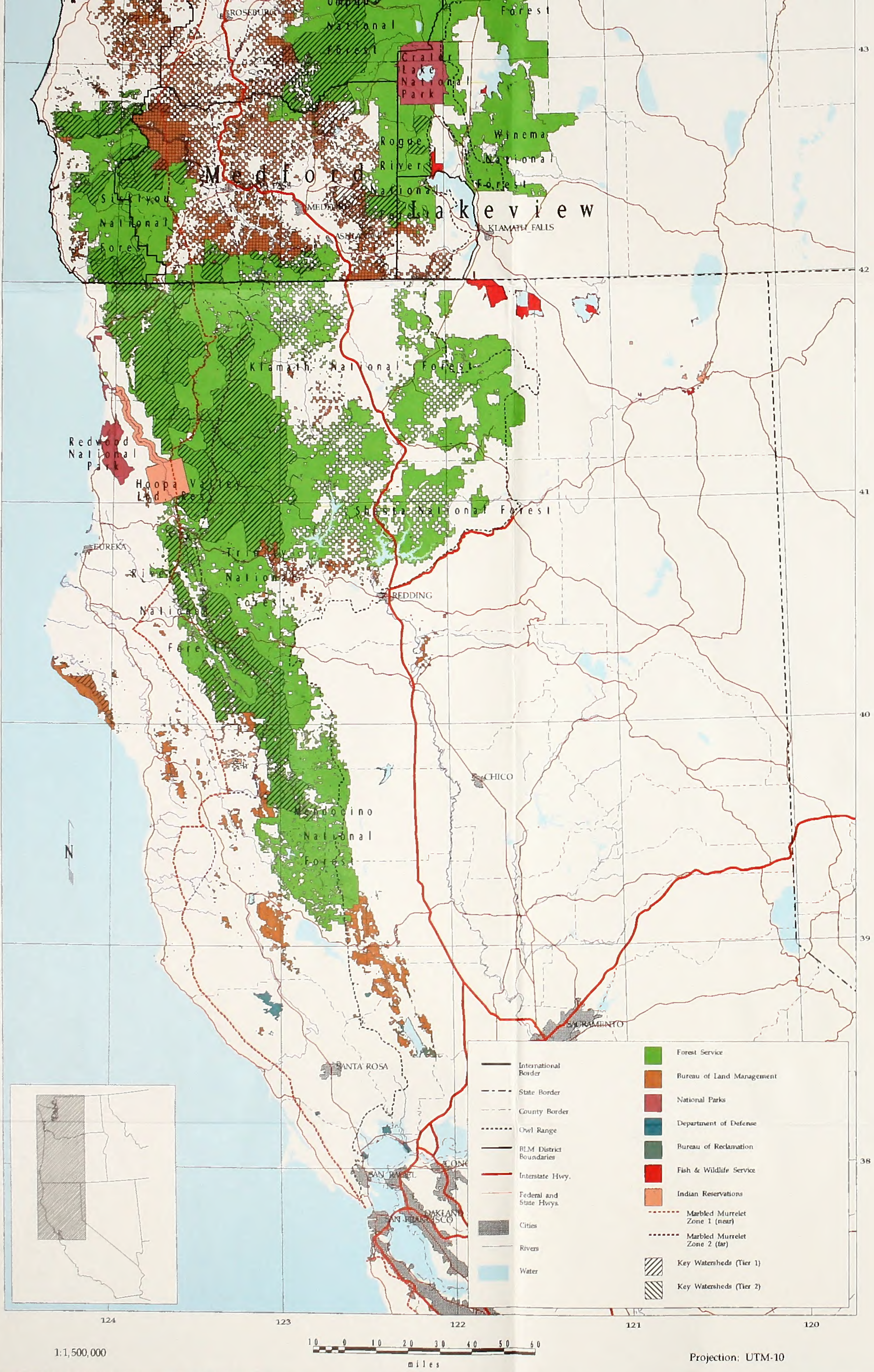
# Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

## Report of the Forest Ecosystem Management Assessment Team

### Federal Land Ownership Within the Range of the Northern Spotted Owl

July 1993

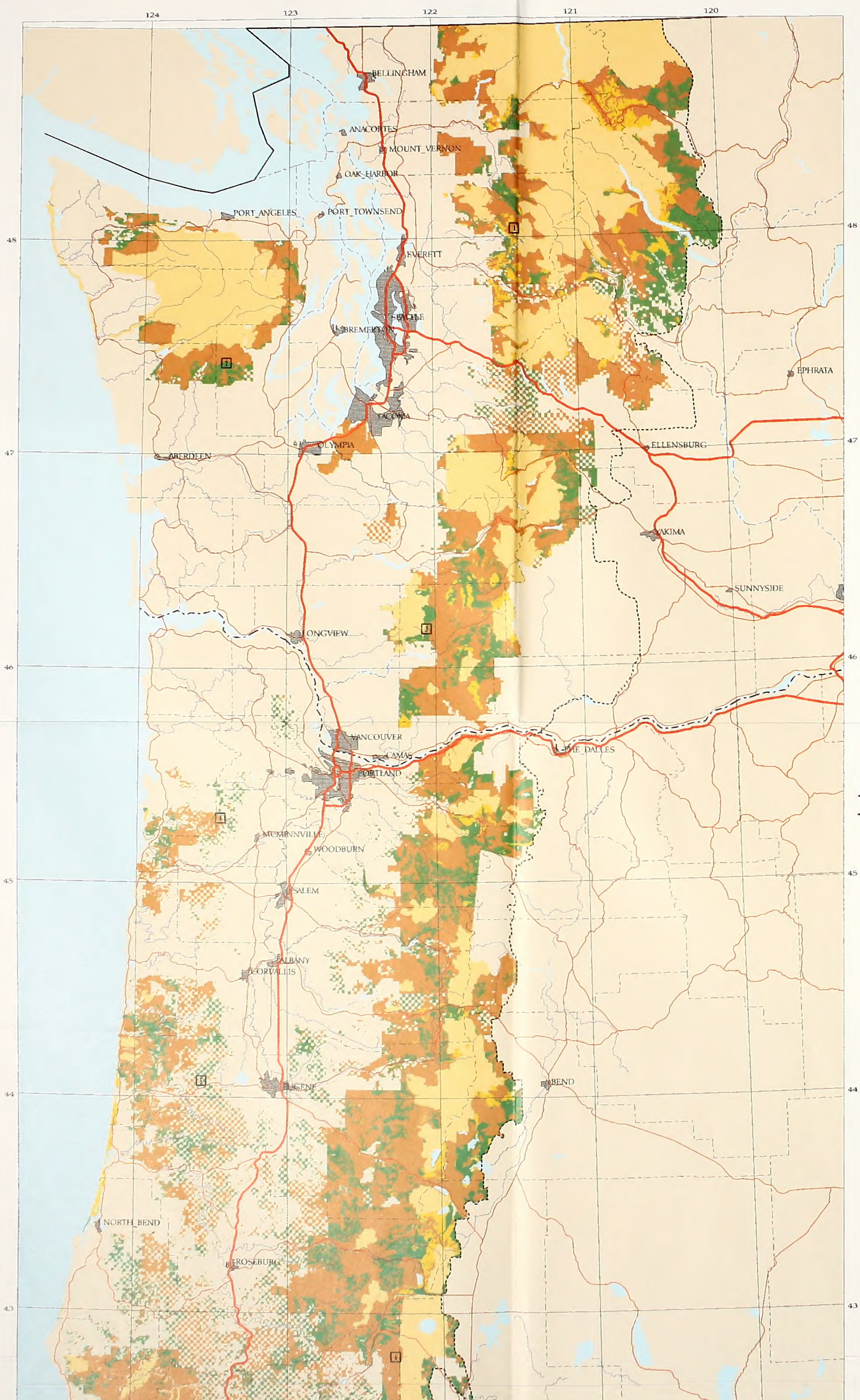
# Draft Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl



1:1,500,000

Projection: UTM-10

No warranty is made for the use of these data beyond the purpose intended by the Forest Ecosystem Management Assessment Team



# Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

## Report of the Forest Ecosystem Management Assessment Team

Federal Land Allocations

Proposed Under Option 1

July 1993

# Draft Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl

Federal Land Allocations

Proposed Under Alternative 1

The land allocations depicted in this map are intended to display the extent and location of the major features of Option 1, one of ten Options described in the accompanying text 'Forest Ecosystem Management: An Ecological, Economic, and Social Assessment.' This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

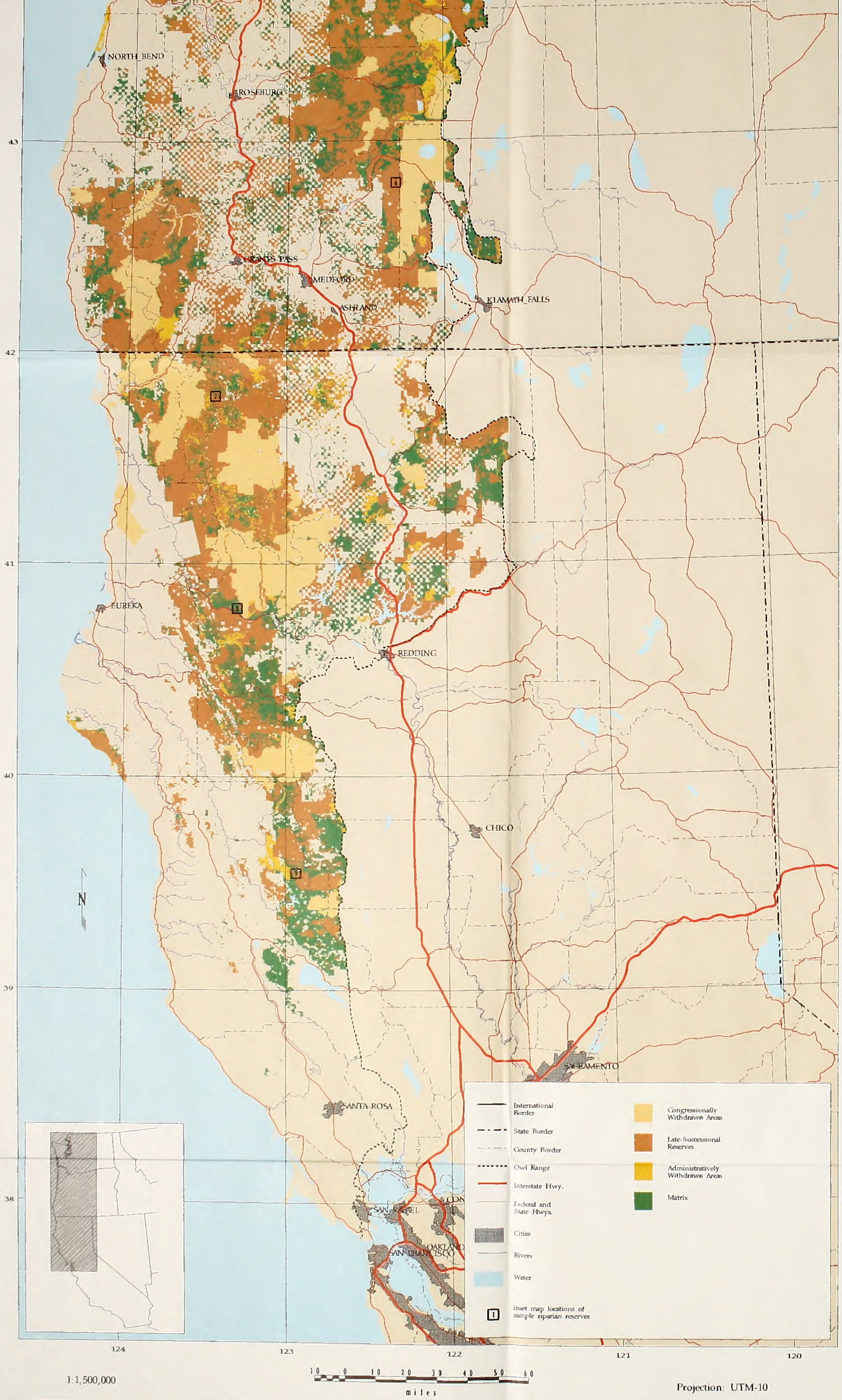
LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

RIPARIAN RESERVES are areas designated along perennial and intermittent streams and wetlands where cutting of trees is limited to silvicultural treatment of young forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.



1:1,500,000

Projection: UTM-10

Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

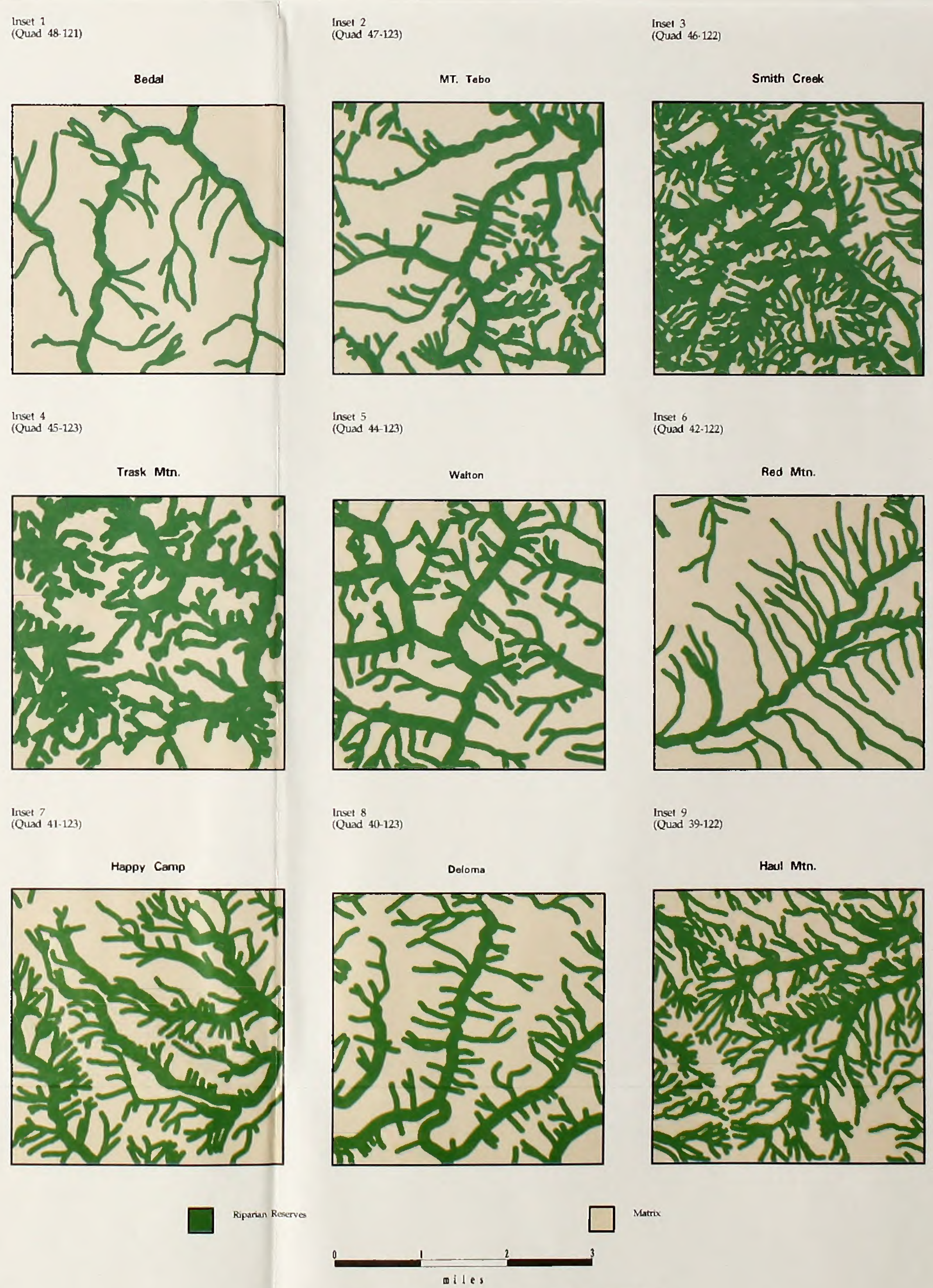
organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

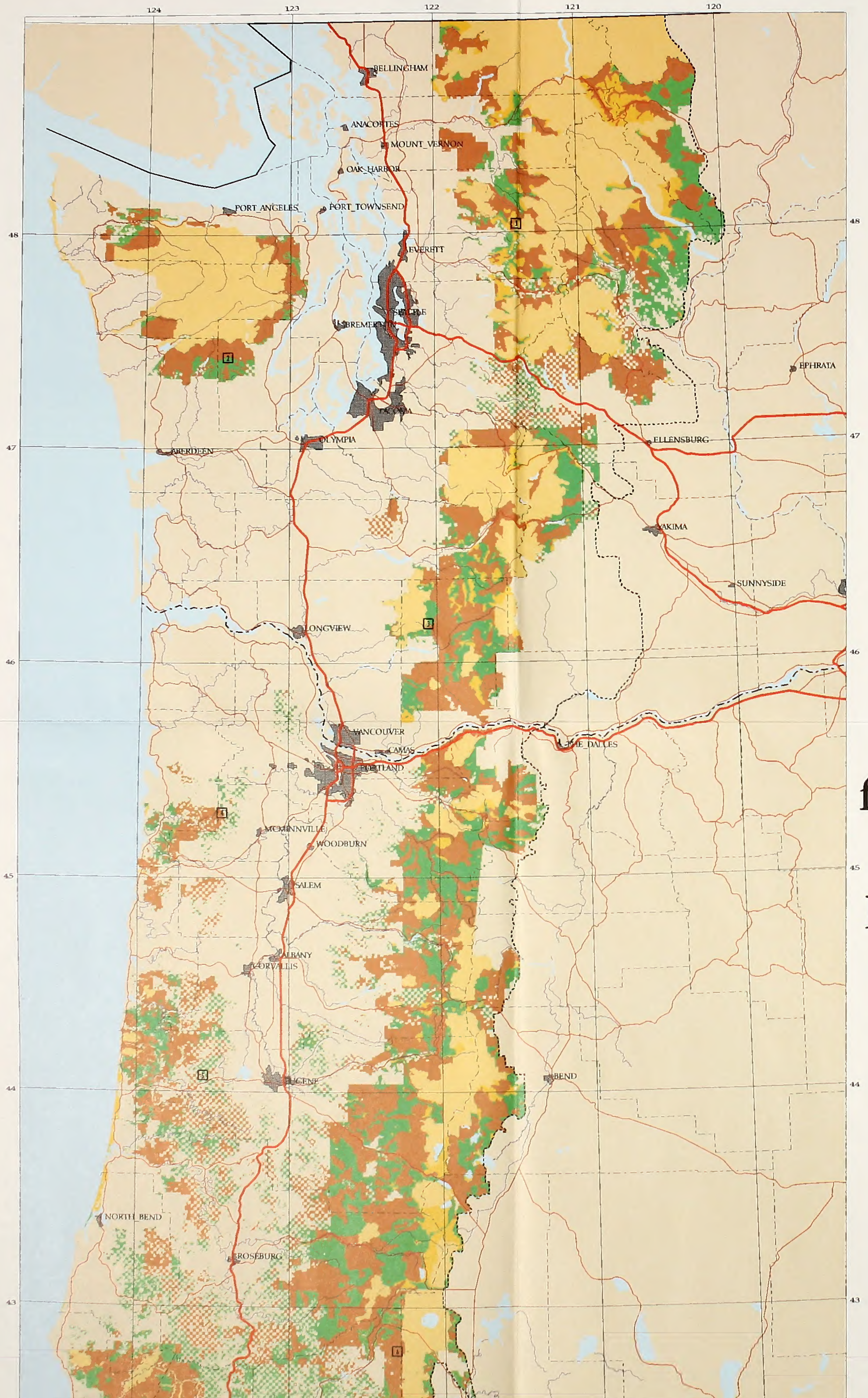
MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.

## Sample Distributions of Riparian Reserves



Inset numbers correspond to numbers within boxes in map. Quad numbers refer to lower right corner of the 1-degree latitude-longitude grid blocks.

No warranty is made for the use of these data beyond the purpose intended by the Forest Ecosystem Management Assessment Team



# Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

## Report of the Forest Ecosystem Management Assessment Team

Federal Land Allocations

Proposed Under Option 2

July 1993

# Draft Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl

Federal Land Allocations

Proposed Under Alternative 2

The land allocations depicted in this map are intended to display the extent and location of the major features of Option 2, one of ten Options described in the accompanying text 'Forest Ecosystem Management: An Ecological, Economic, and Social Assessment.' This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

RIPARIAN RESERVES are areas designated along perennial and intermittent streams and wetlands where cutting of trees is limited to silvicultural treatment of young forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.

accompanying text "Forest Ecosystem Management: An Ecological, Economic, and Social Assessment." This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

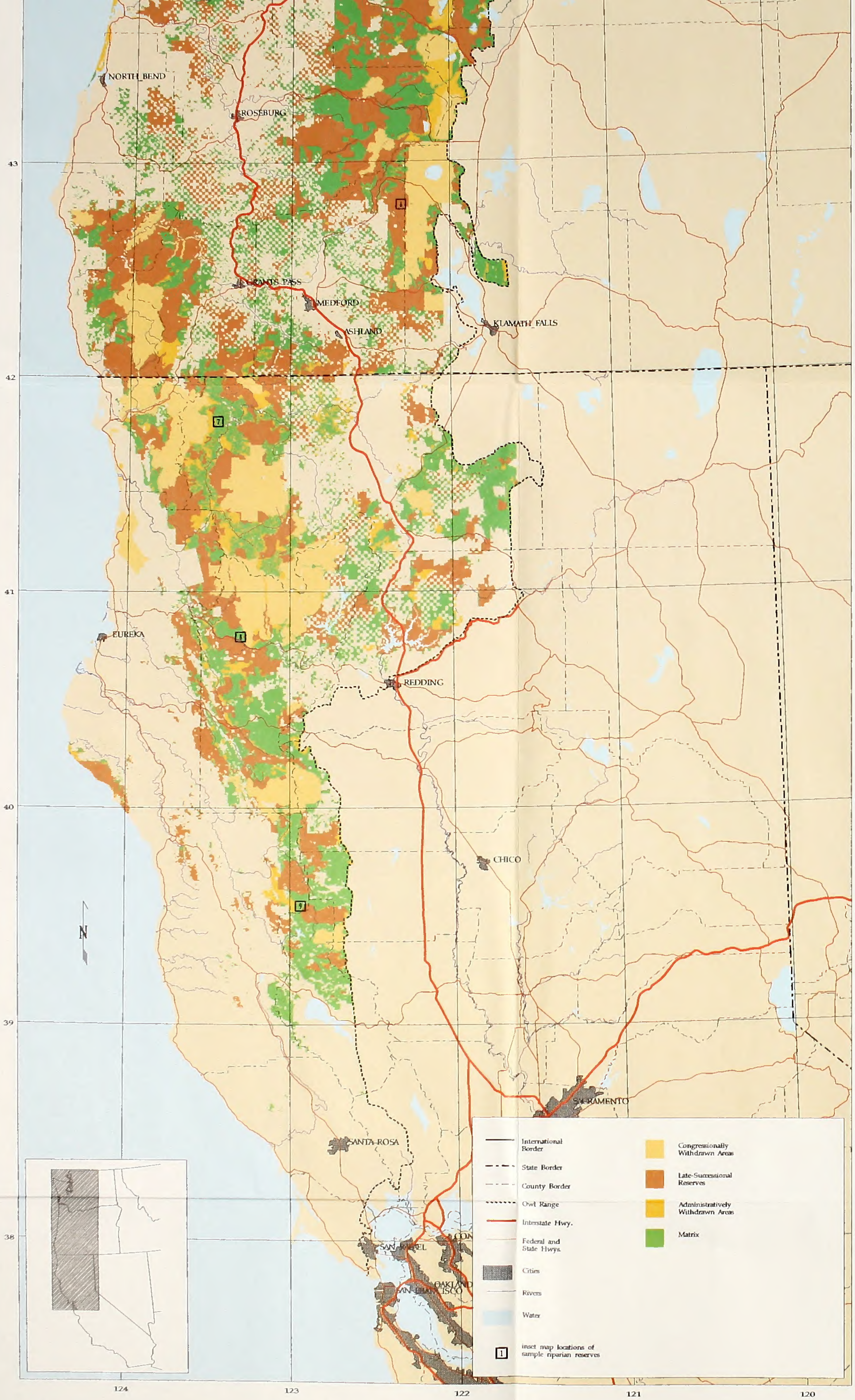
LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.

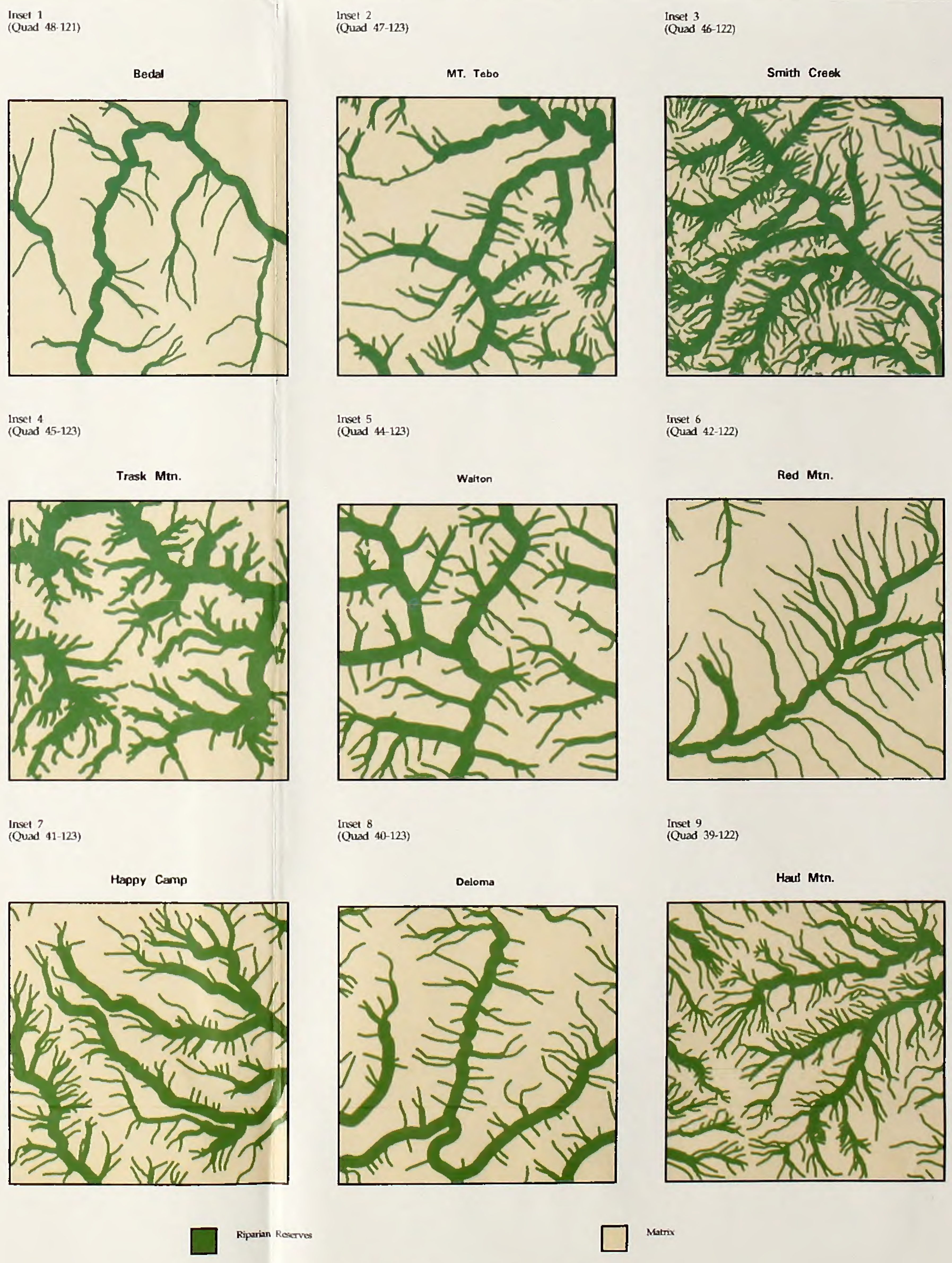


1:1,500,000

10 0 10 20 30 40 50 60
miles

Projection: UTM-10

## Sample Distributions of Riparian Reserves


Inset 1 (Quad 48-121) Bedal

Inset 2 (Quad 47-123) MT. Tebo

Inset 3 (Quad 46-122) Smith Creek

Inset 4 (Quad 45-123) Trask Mtn.

Inset 5 (Quad 44-123) Walton

Inset 6 (Quad 42-122) Red Mtn.

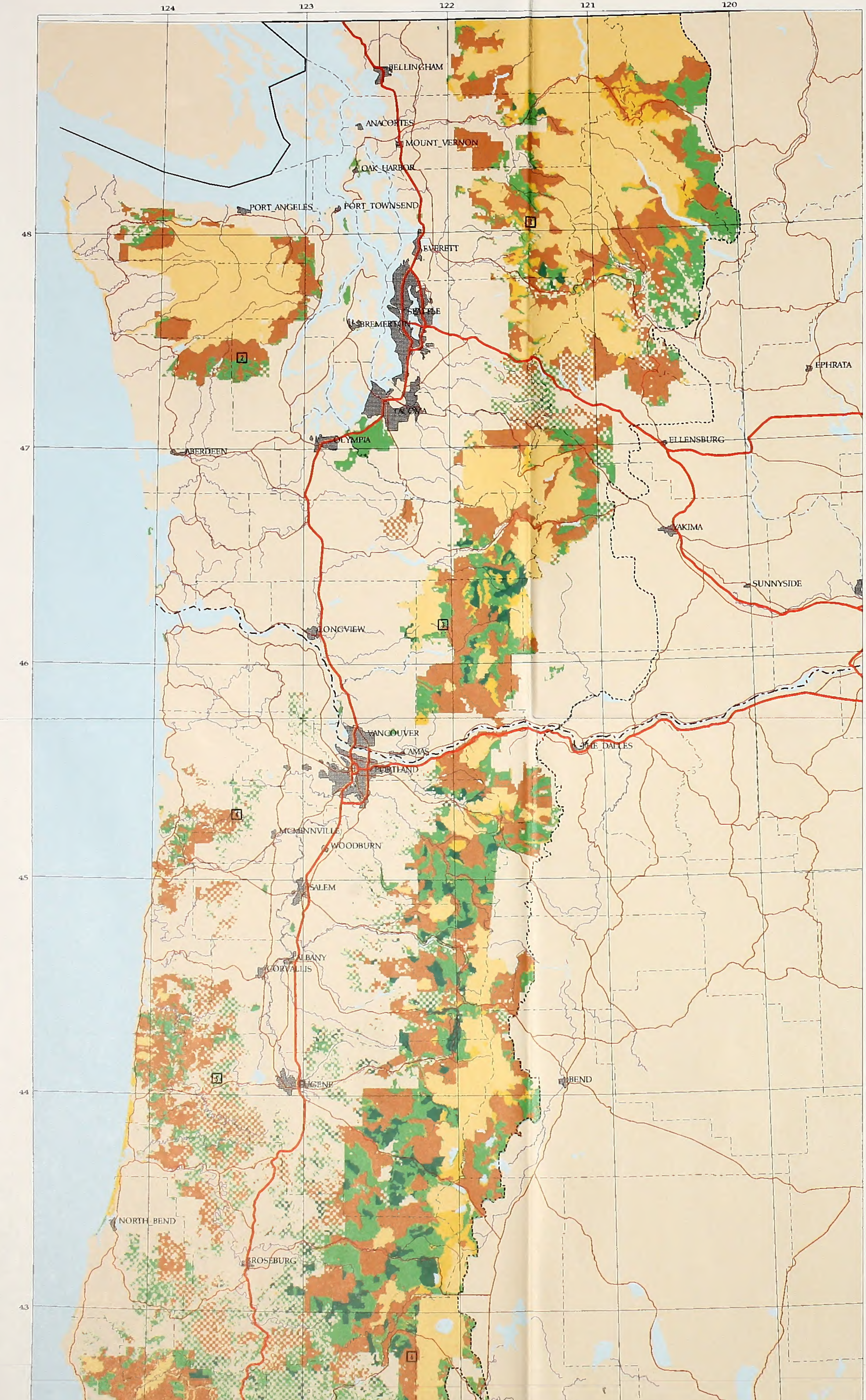
Inset 7 (Quad 41-123) Happy Camp

Inset 8 (Quad 40-123) Deloma

Inset 9 (Quad 39-122) Haul Mtn.

Inset numbers correspond to numbers within boxes in map. Quad numbers refer to lower right corner of the 1-degree latitude-longitude grid blocks.

No warranty is made for the use of these data beyond the purpose intended by the Forest Ecosystem Management Assessment Team



# Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

## Report of the Forest Ecosystem Management Assessment Team

### Federal Land Allocations Proposed Under Option 3

July 1993

# Draft Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl

### Federal Land Allocations

### Proposed Under Alternative 3

The land allocations depicted in this map are intended to display the extent and location of the major features of Option 3, one of ten Options described in the accompanying text "Forest Ecosystem Management: An Ecological, Economic, and Social Assessment." This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

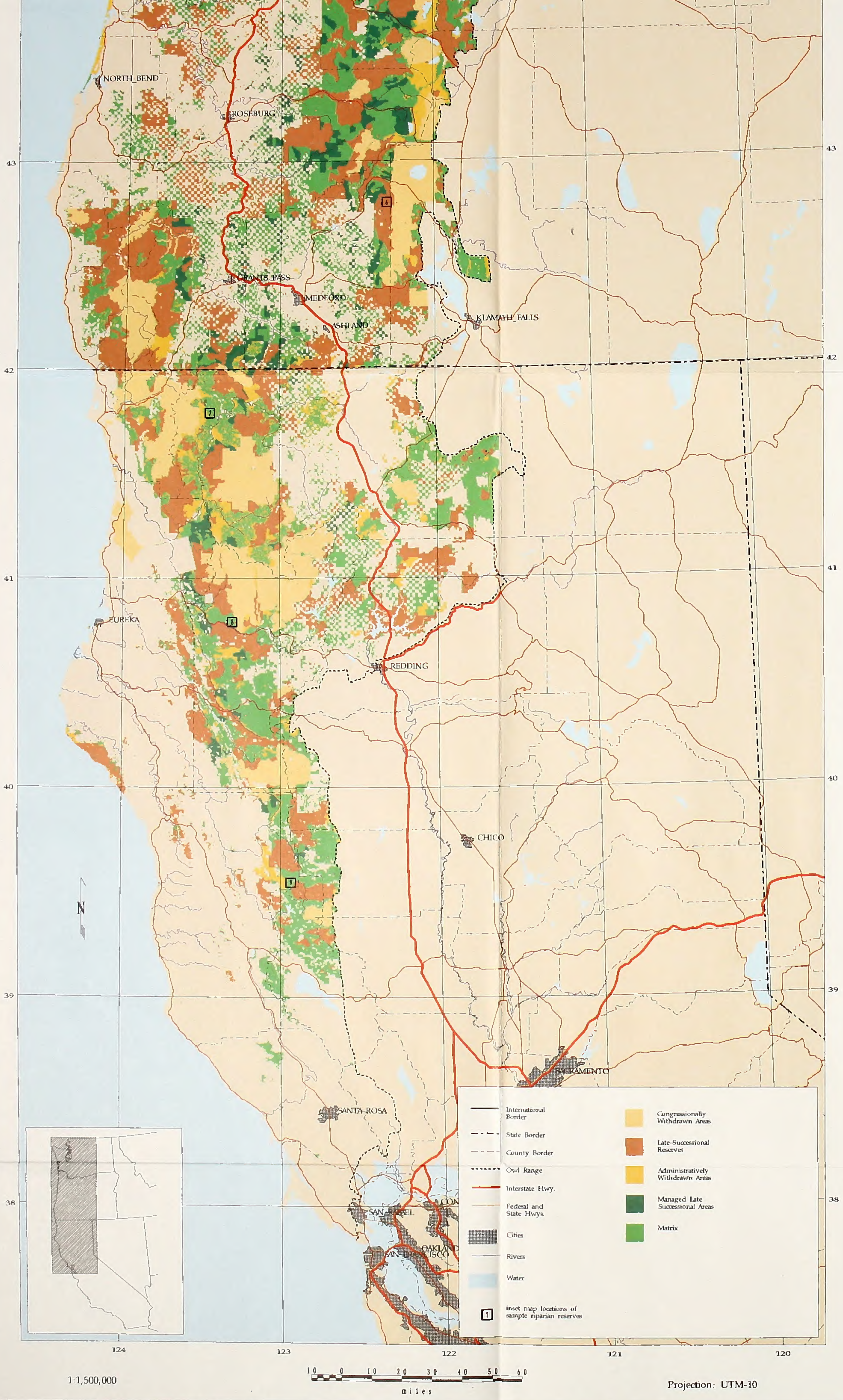
LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

RIPARIAN RESERVES are areas designated along perennial and intermittent streams and wetlands where cutting of trees is limited to silvicultural treatment of young forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.



accompanying text "Forest Ecosystem Management: An Ecological, Economic, and Social Assessment." This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

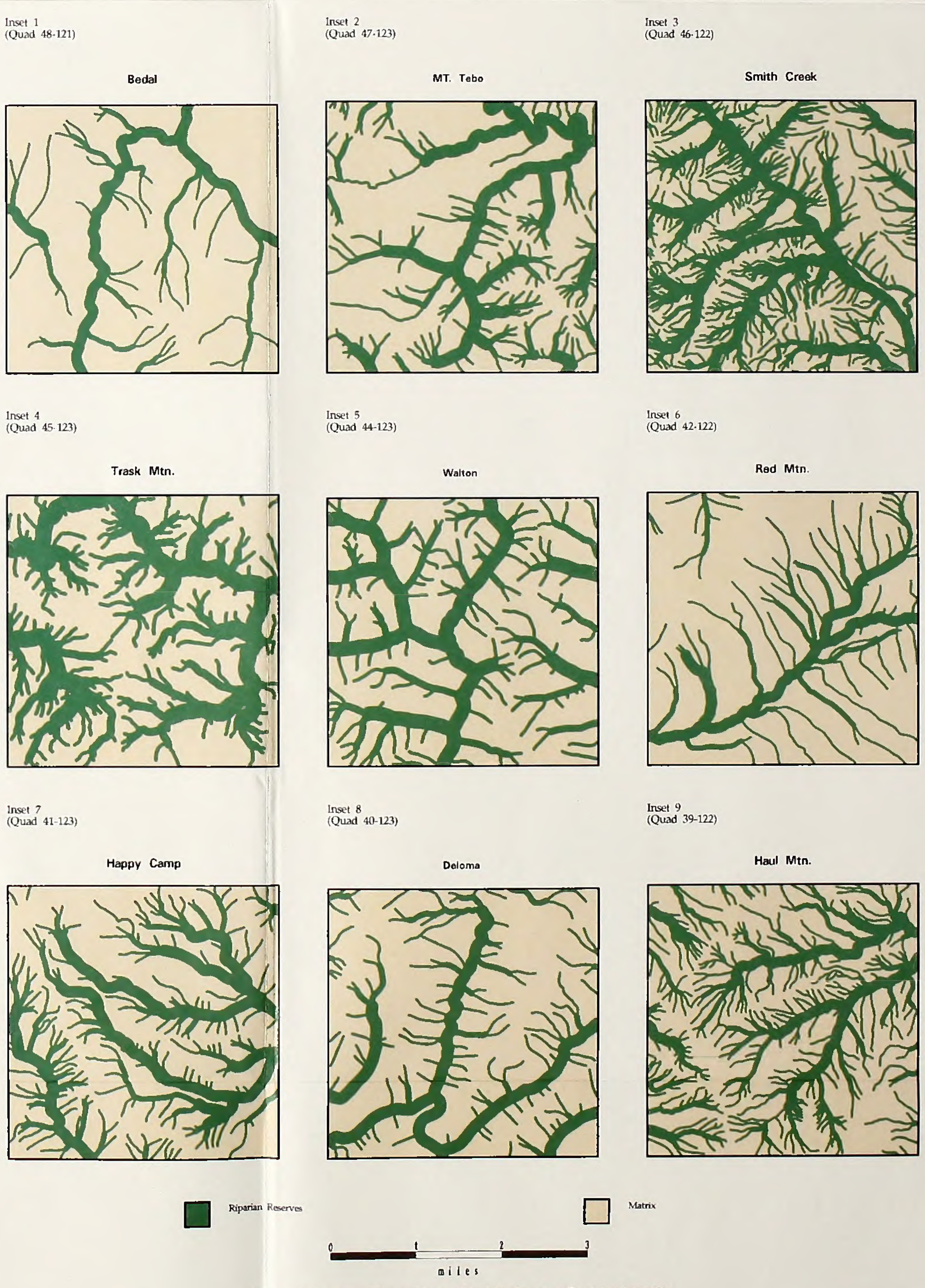
forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

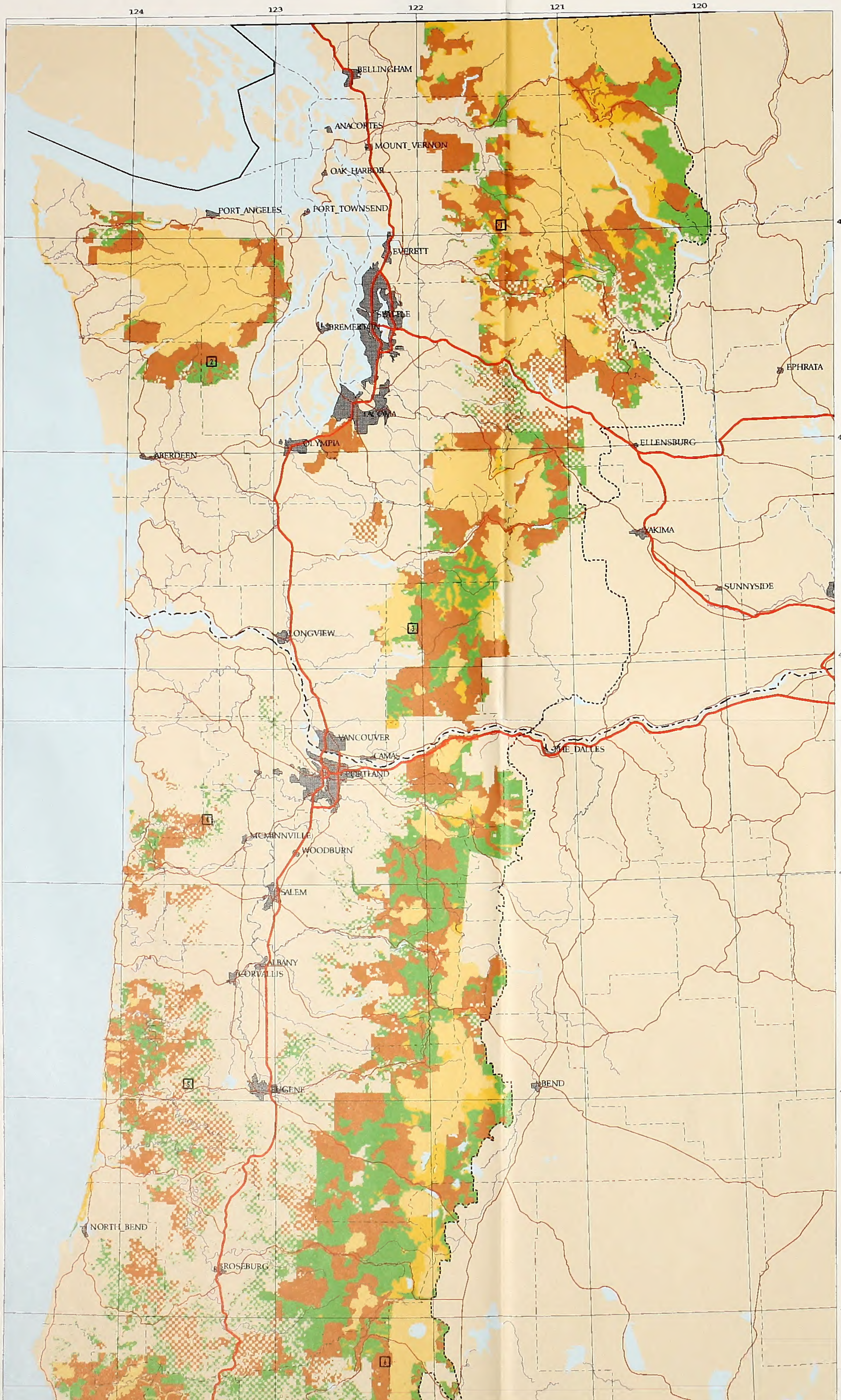
MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.

## Sample Distributions of Riparian Reserves



Inset numbers correspond to numbers within boxes in map. Quad numbers refer to lower right corner of the 1-degree latitude-longitude grid blocks.

No warranty is made for the use of these data beyond the purpose intended by the Forest Ecosystem Management Assessment Team



# Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

## Report of the Forest Ecosystem Management Assessment Team

Federal Land Allocations
Proposed Under Option 4

July 1993

# Draft Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl

Federal Land Allocations

Proposed Under Alternative 4

The land allocations depicted in this map are intended to display the extent and location of the major features of Option 4, one of ten Options described in the accompanying text 'Forest Ecosystem Management: An Ecological, Economic, and Social Assessment.' This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

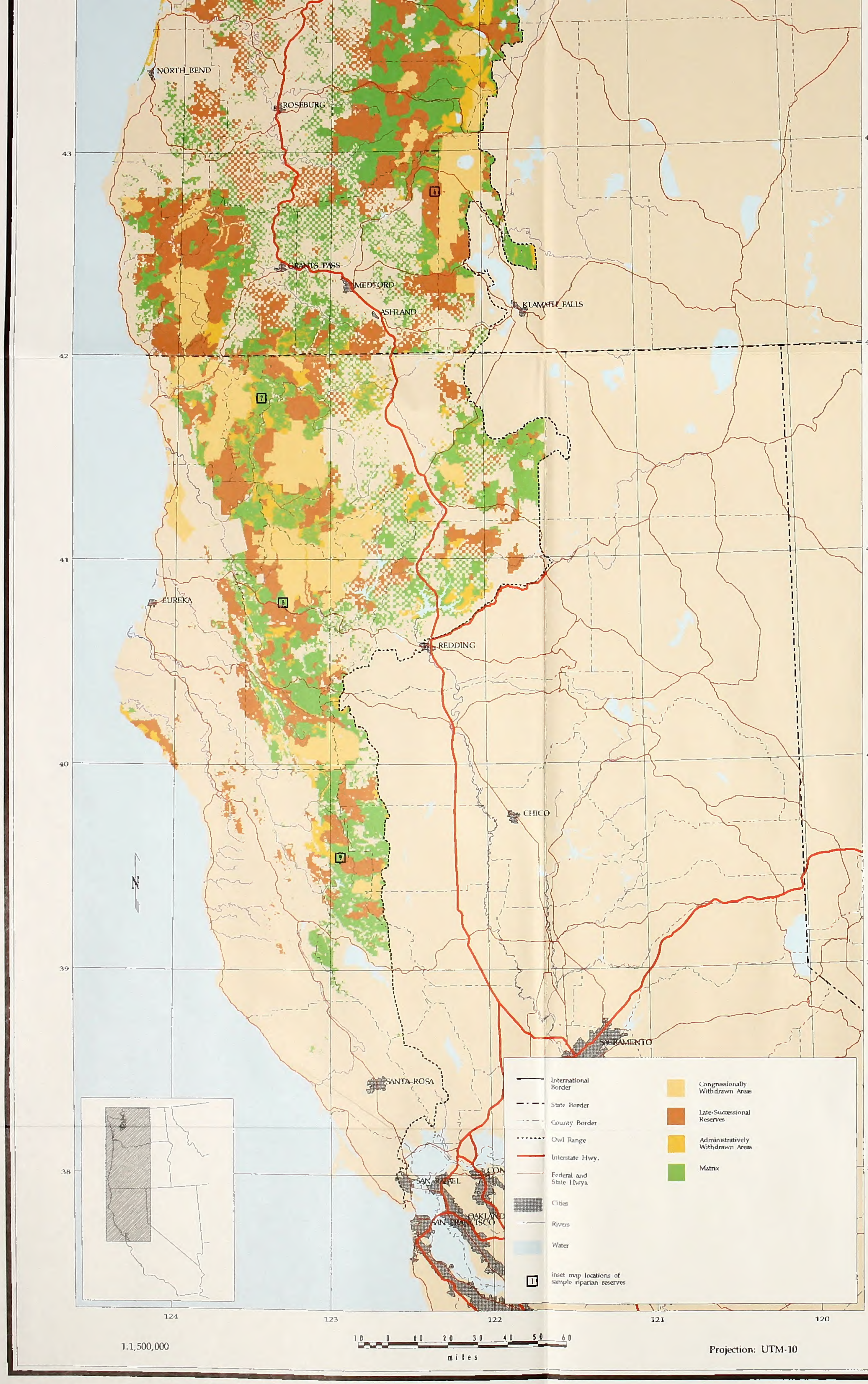
LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

RIPARIAN RESERVES are areas designated along perennial and intermittent streams and wetlands where cutting of trees is limited to silvicultural treatment of young forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.



1:1,500,000

Projection: UTM-10

Ecological, Economic, and Social Assessment." This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

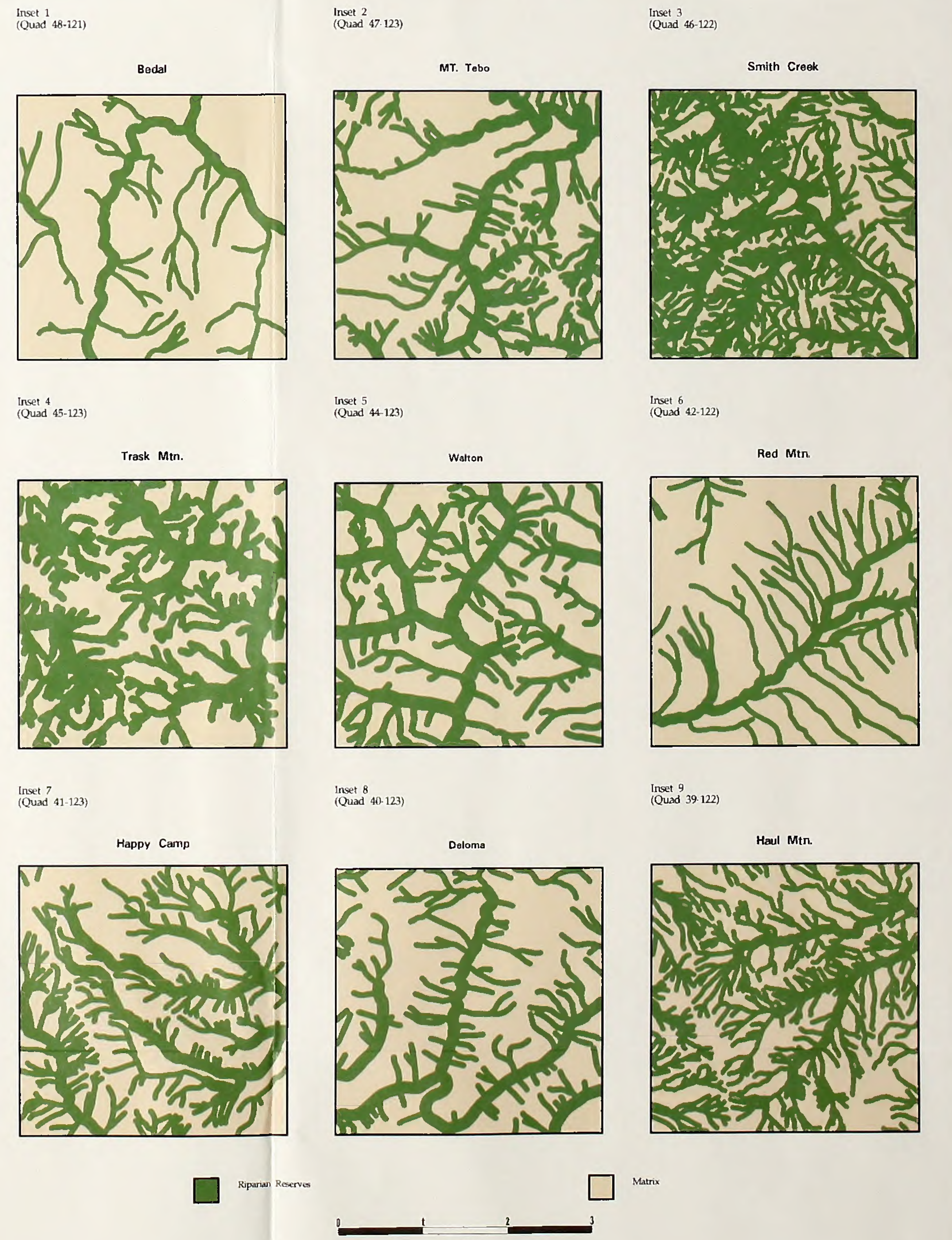
habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

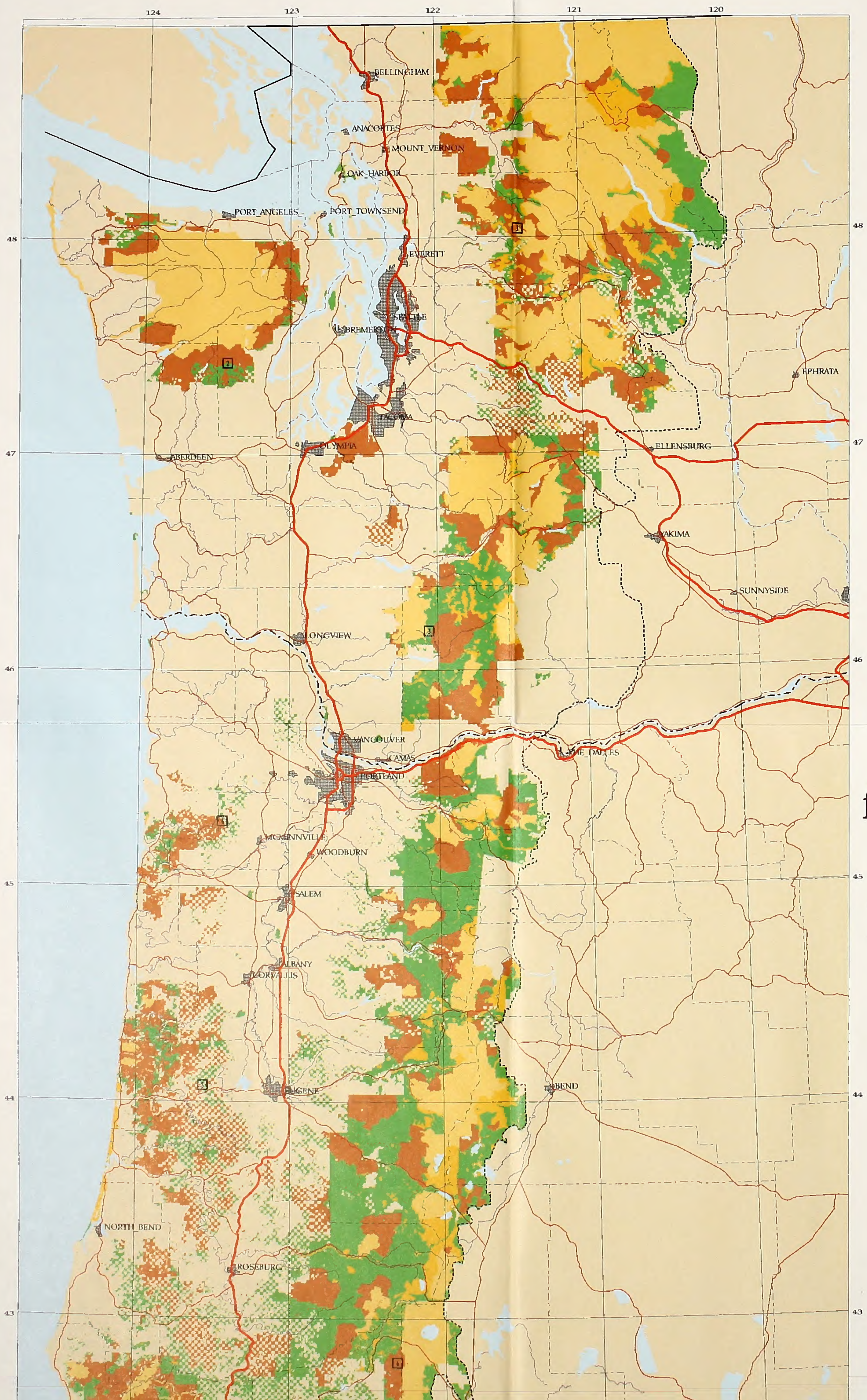
MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.

## Sample Distributions of Riparian Reserves



Inset numbers correspond to numbers within boxes in map. Quad numbers refer to lower right corner of the 1-degree latitude-longitude grid blocks.

No warranty is made for the use of these data beyond the purpose intended by the Forest Ecosystem Management Assessment Team



# Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

## Report of the Forest Ecosystem Management Assessment Team

Federal Land Allocations
Proposed Under Option 5

July 1993

# Draft Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl

Federal Land Allocations

Proposed Under Alternative 5

The land allocations depicted in this map are intended to display the extent and location of the major features of Option 5, one of ten Options described in the accompanying text "Forest Ecosystem Management: An Ecological, Economic, and Social Assessment." This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

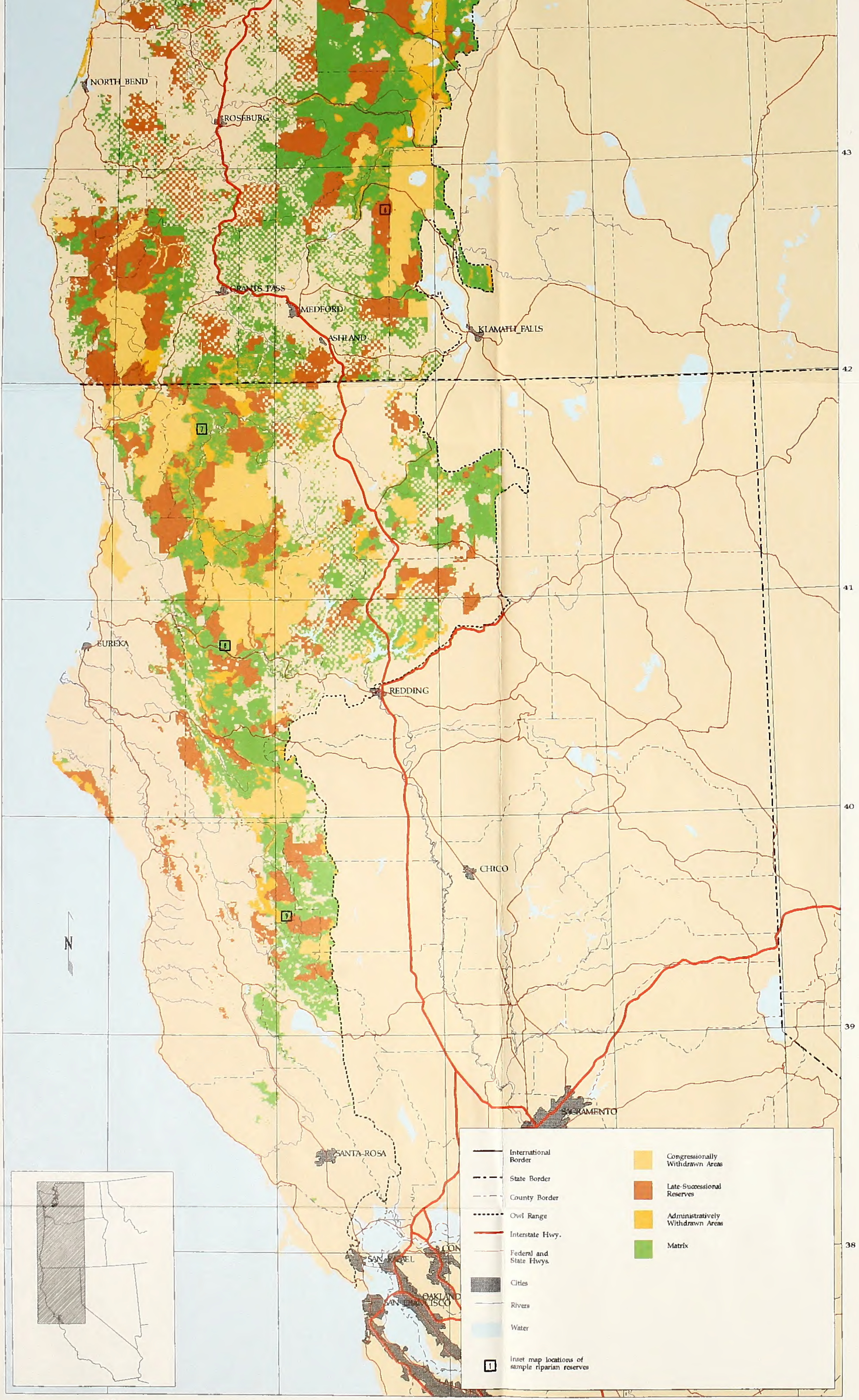
LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

RIPARIAN RESERVES are areas designated along perennial and intermittent streams and wetlands where cutting of trees is limited to silvicultural treatment of young forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.



1:1,500,000

10 0 10 20 30 40 50 60

miles

Projection: UTM-10

accompanying text "Forest Ecosystem Management: An Ecological, Economic, and Social Assessment." This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

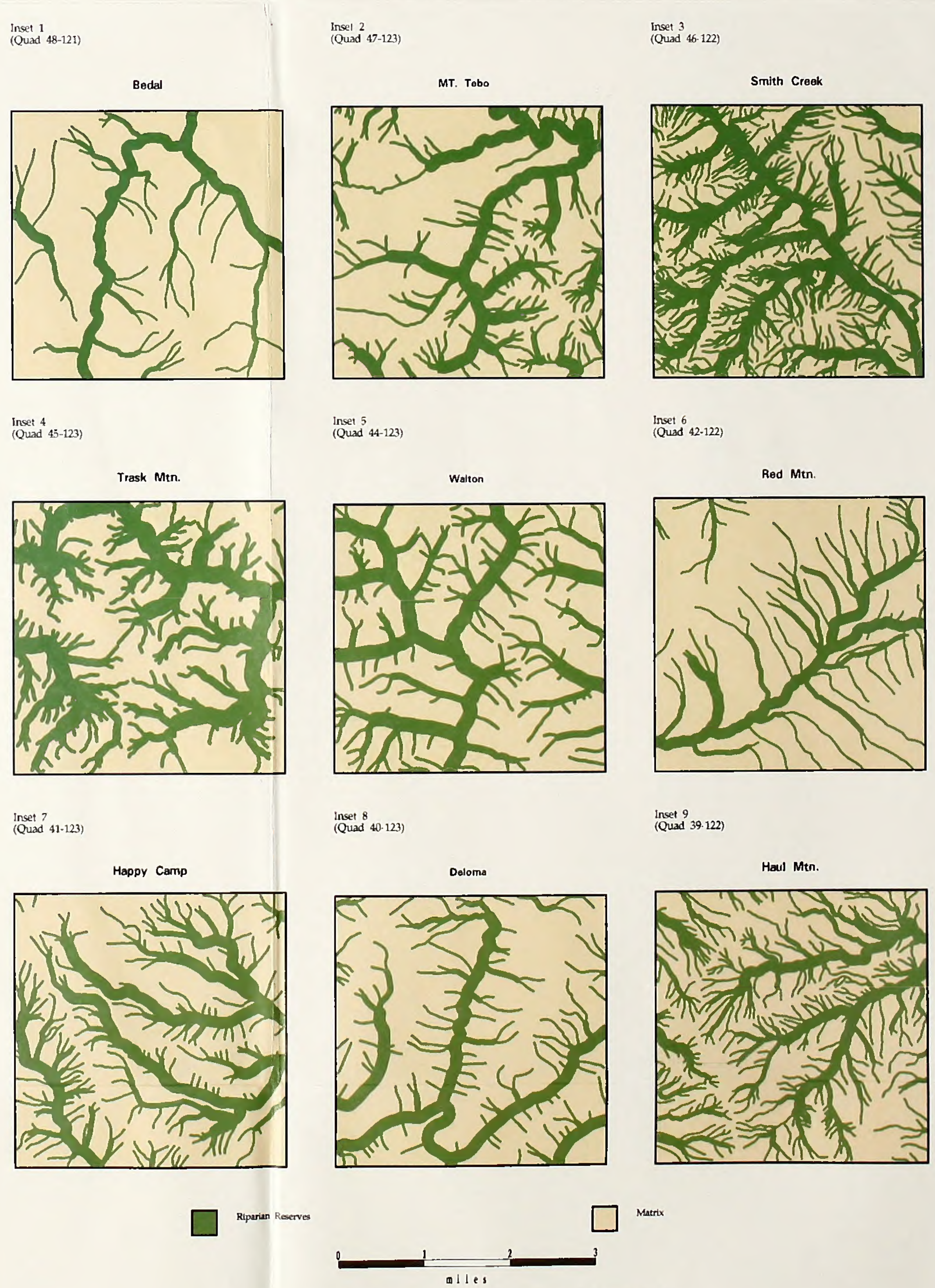
forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

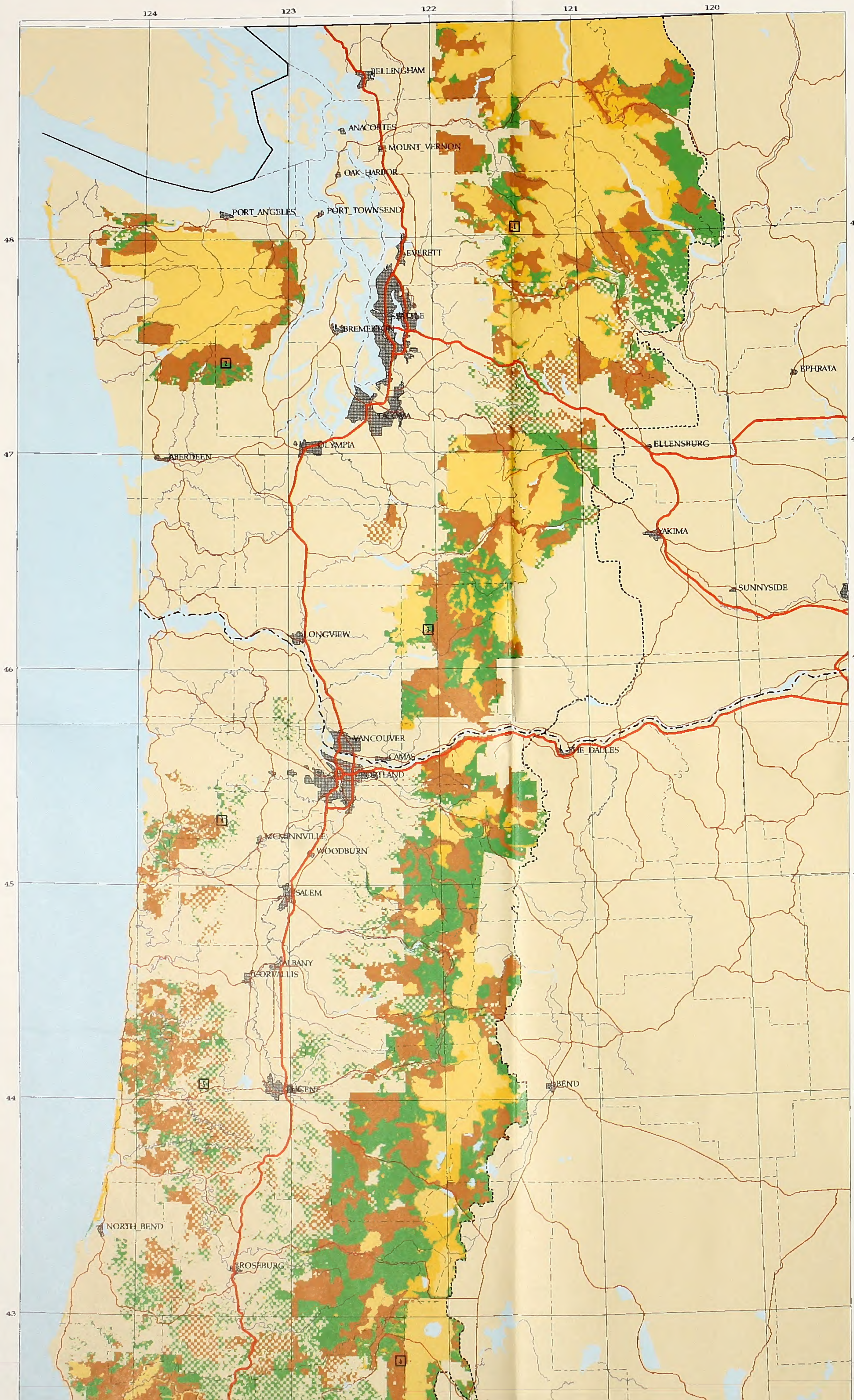
MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.

## Sample Distributions of Riparian Reserves



Inset numbers correspond to numbers within boxes in map. Quad numbers refer to lower right corner of the 1-degree latitude-longitude grid blocks.

No warranty is made for the use of these data beyond the purpose intended by the Forest Ecosystem Management Assessment Team



# Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

## Report of the Forest Ecosystem Management Assessment Team

Federal Land Allocations

Proposed Under Options 6, 8 and 10

July 1993

# Draft Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl

Federal Land Allocations

Proposed Under Alternatives 6, 8 and 10

The land allocations depicted in this map are intended to display the extent and location of the major features of Option 6, 8 and 10, three of ten Options described in the accompanying text "Forest Ecosystem Management: An Ecological, Economic, and Social Assessment." This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

RIPARIAN RESERVES are areas designated along perennial and intermittent streams and wetlands where cutting of trees is limited to silvicultural treatment of young forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.

Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

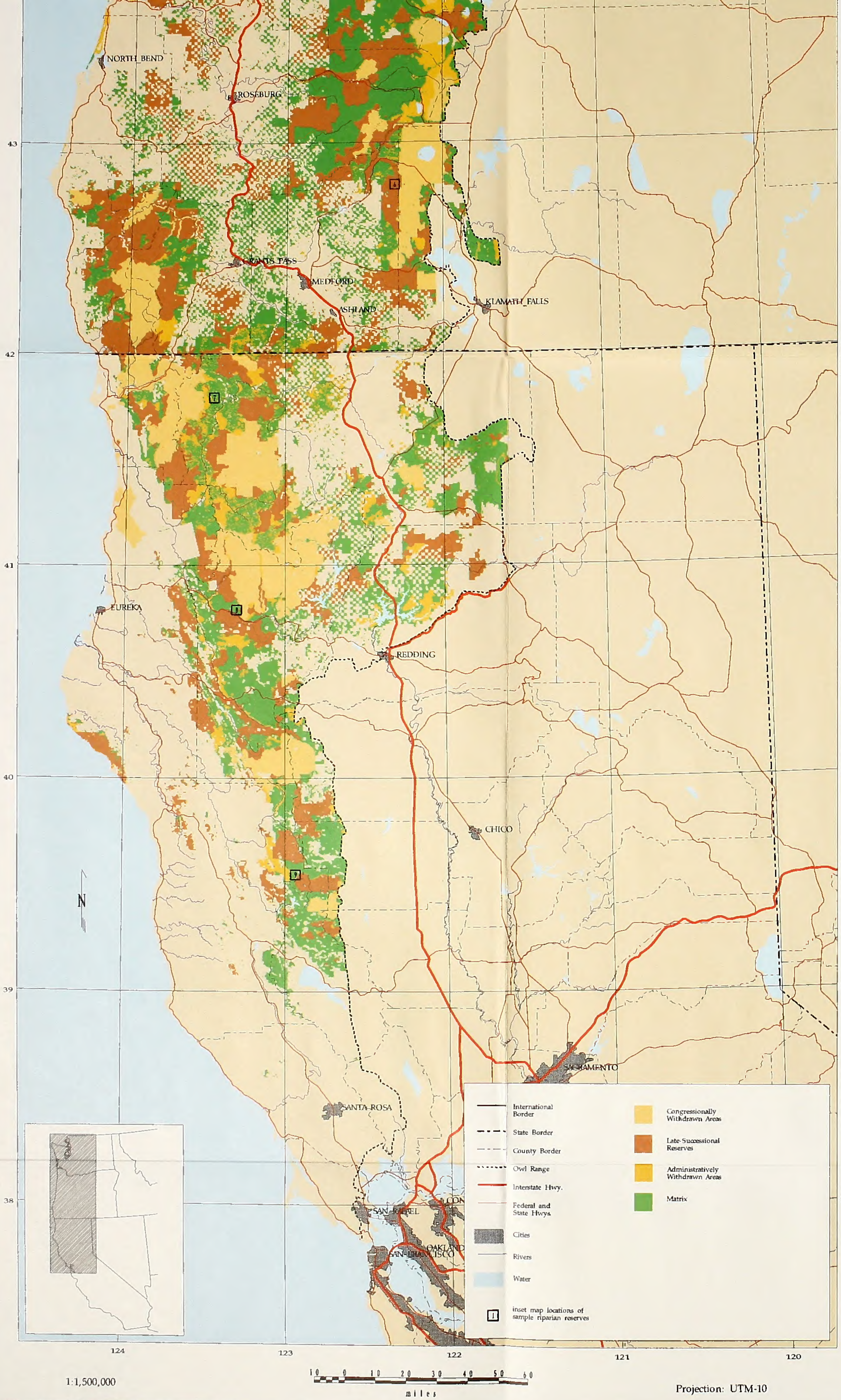
LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.

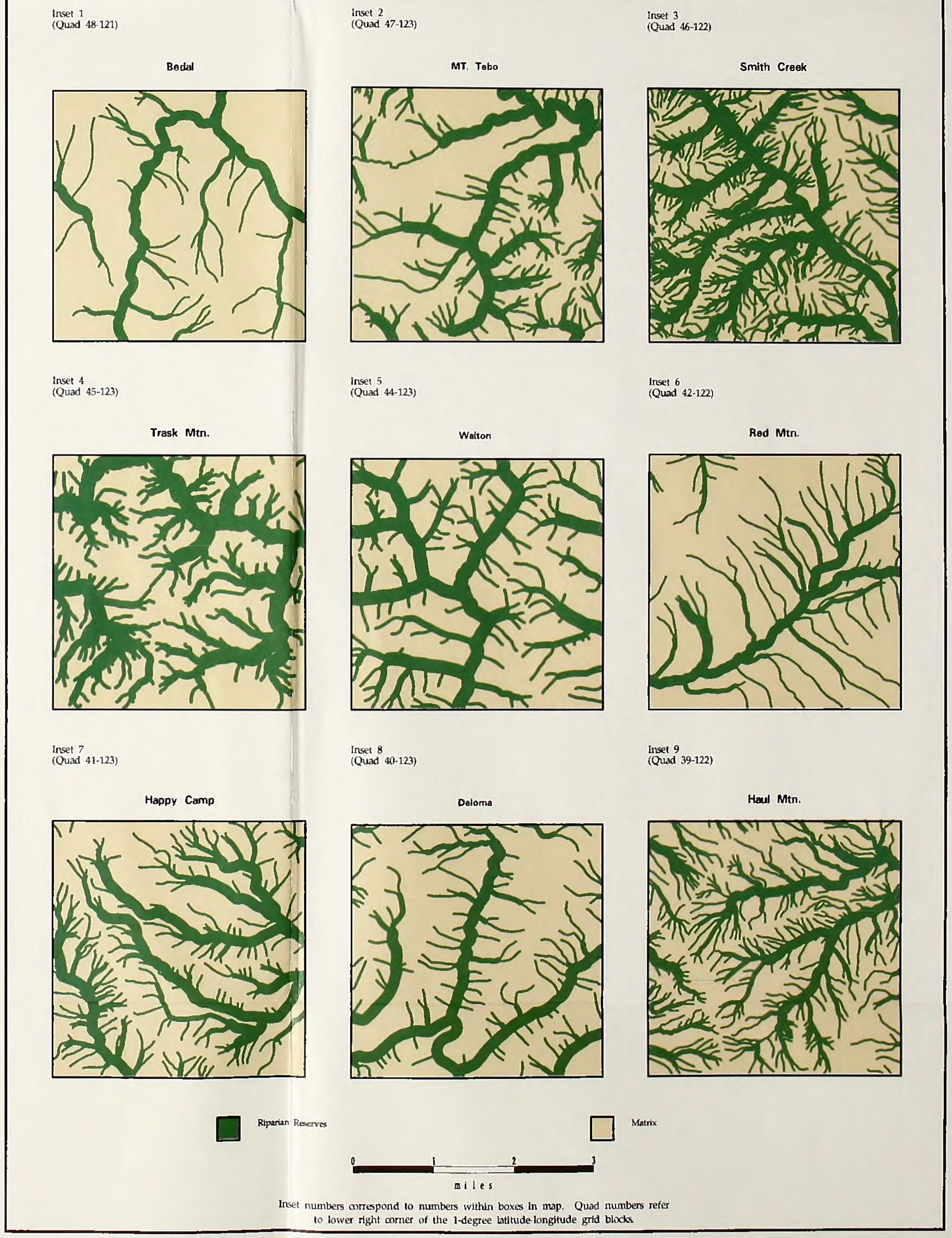


1:1,500,000

Projection: UTM-10

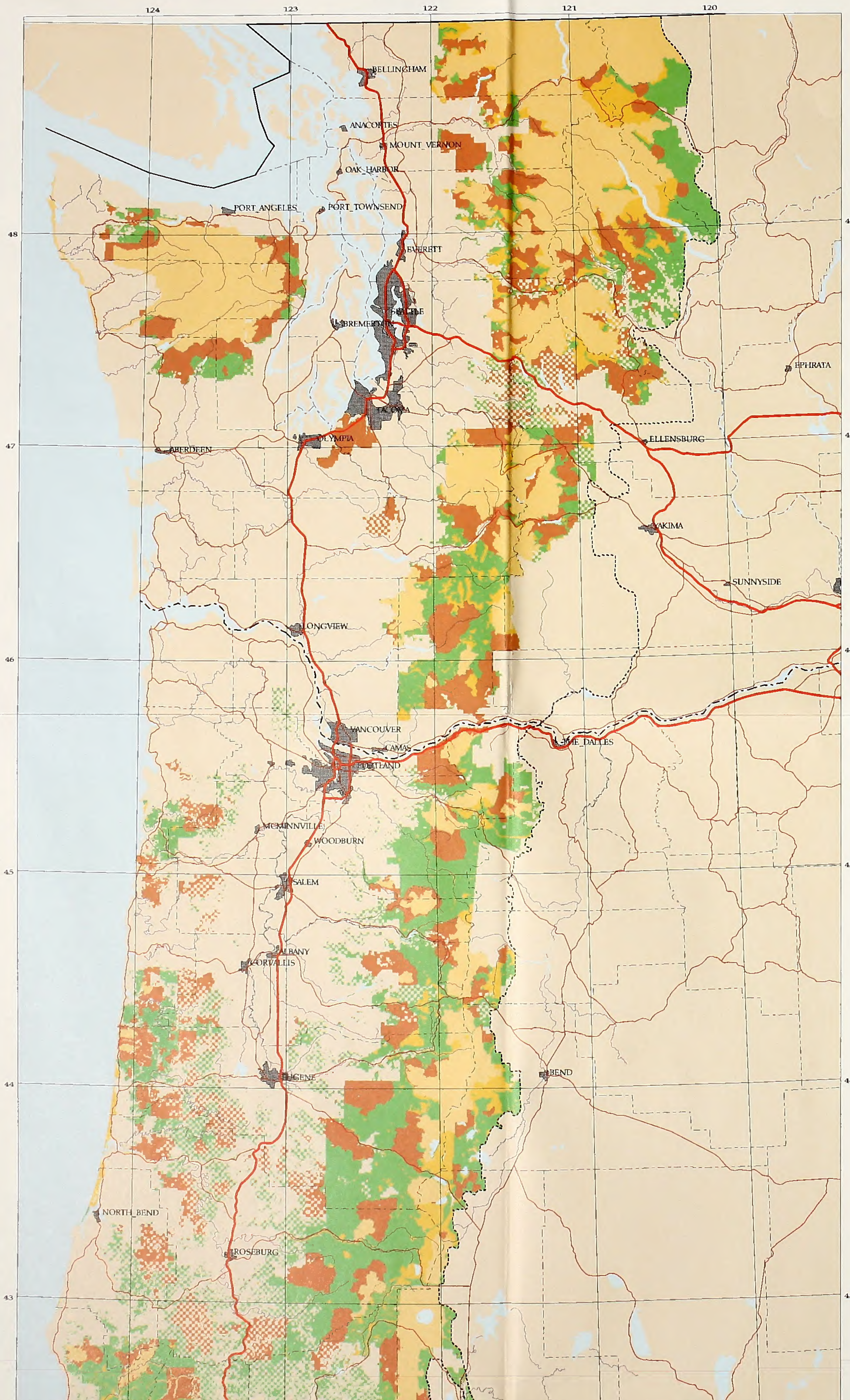
## Sample Distributions of Riparian Reserves

The Riparian Reserves for Option 8 are smaller than displayed for non-fishbearing streams.



Inset numbers correspond to numbers within boxes in map. Quad numbers refer to lower right corner of the 1-degree latitude-longitude grid blocks.

No warranty is made for the use of these data beyond the purpose intended by the Forest Ecosystem Management Assessment Team



# Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

## Report of the Forest Ecosystem Management Assessment Team

Federal Land Allocations
Proposed Under Option 7

July 1993

# Draft Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl

Federal Land Allocations

Proposed Under Alternative 7

The land allocations depicted in this map are intended to display the extent and location of the major features of Option 7, one of ten Options described in the accompanying text "Forest Ecosystem Management: An Ecological, Economic, and Social Assessment." This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

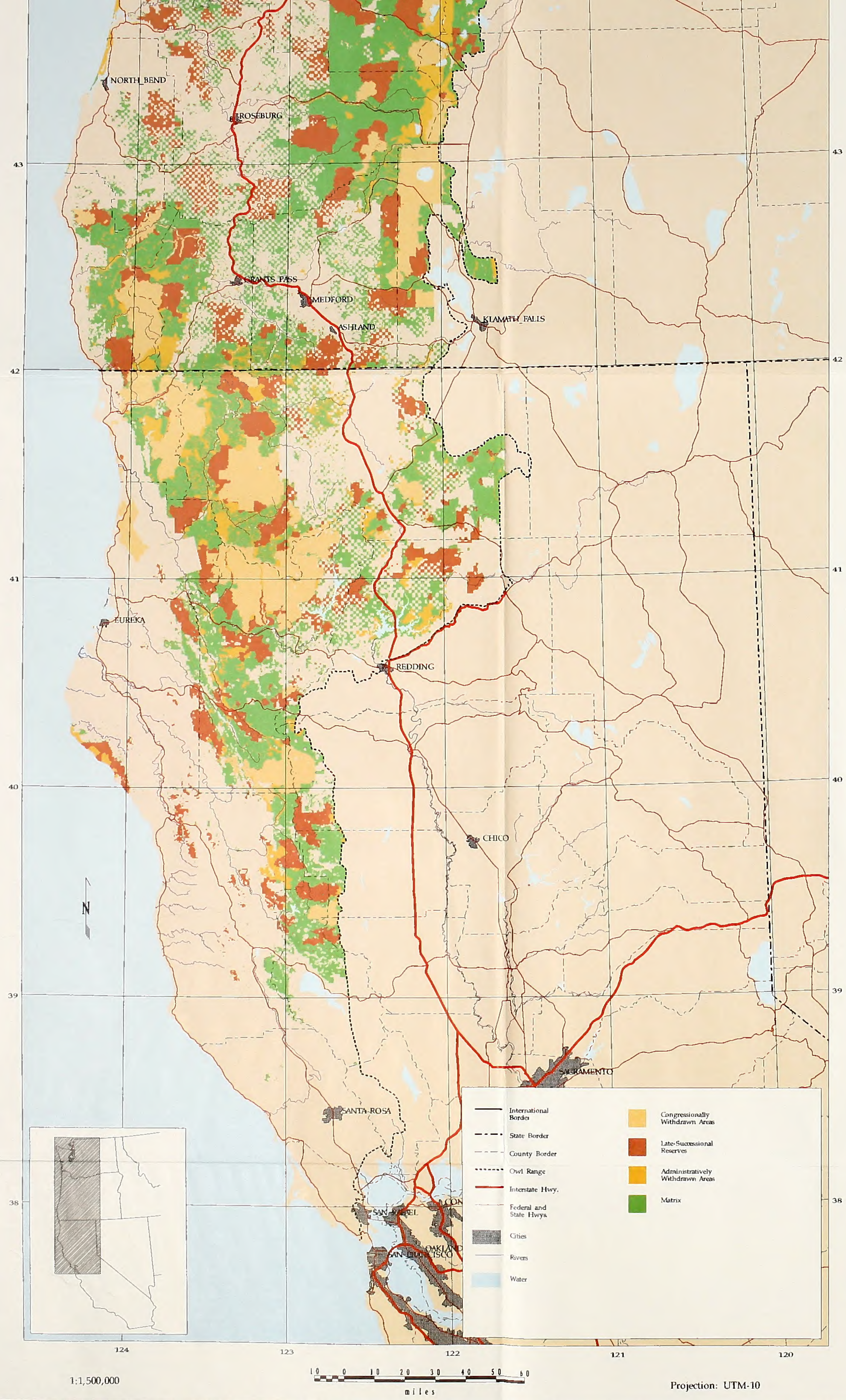
LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

RIPARIAN RESERVES are areas designated along perennial and intermittent streams and wetlands where cutting of trees is limited to silvicultural treatment of young forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.



of Option 7, one of Ten Options described in the accompanying text "Forest Ecosystem Management: An Ecological, Economic, and Social Assessment." This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

trees is limited to silvicultural treatment of young forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

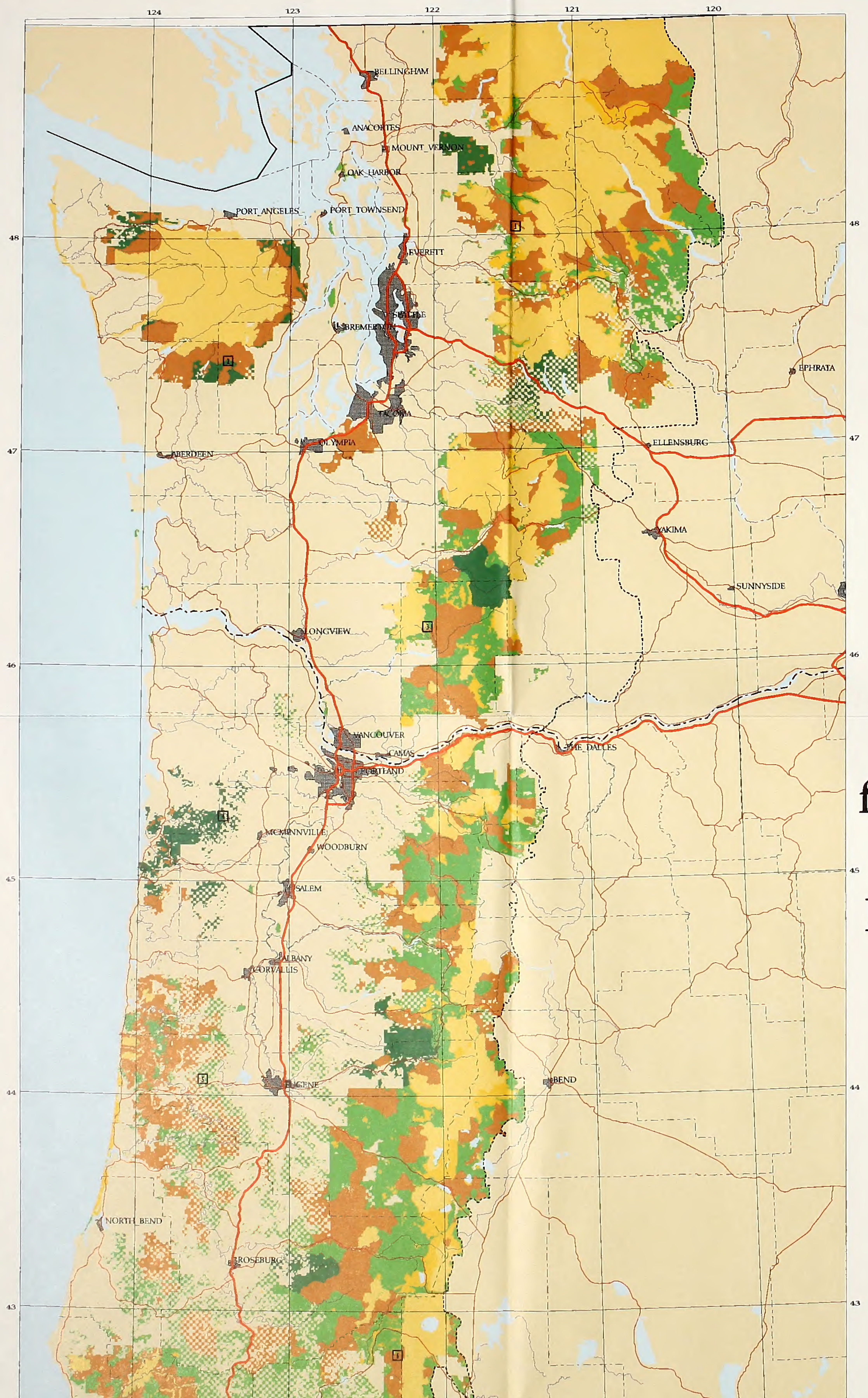
MANAGED LATE-SUCCESSIONAL AREAS include all federal lands within a prescribed boundary where forest lands are subject to limited timber harvest across all age classes. See text for details.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.

Sample distributions of Riparian Reserves are not provided for this option because the buffer design varies among land management plans.

No warranty is made for the use of these data beyond the purpose intended by the Forest Ecosystem Management Assessment Team



# Forest Ecosystem Management: An Ecological, Economic, and Social Assessment

## Report of the Forest Ecosystem Management Assessment Team

Federal Land Allocations
Proposed Under Option 9

July 1993

# Draft Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl

Federal Land Allocations

Proposed Under Alternative 9

The land allocations depicted in this map are intended to display the extent and location of the major features of Option 9, one of ten Options described in the accompanying text 'Forest Ecosystem Management: An Ecological, Economic, and Social Assessment.' This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

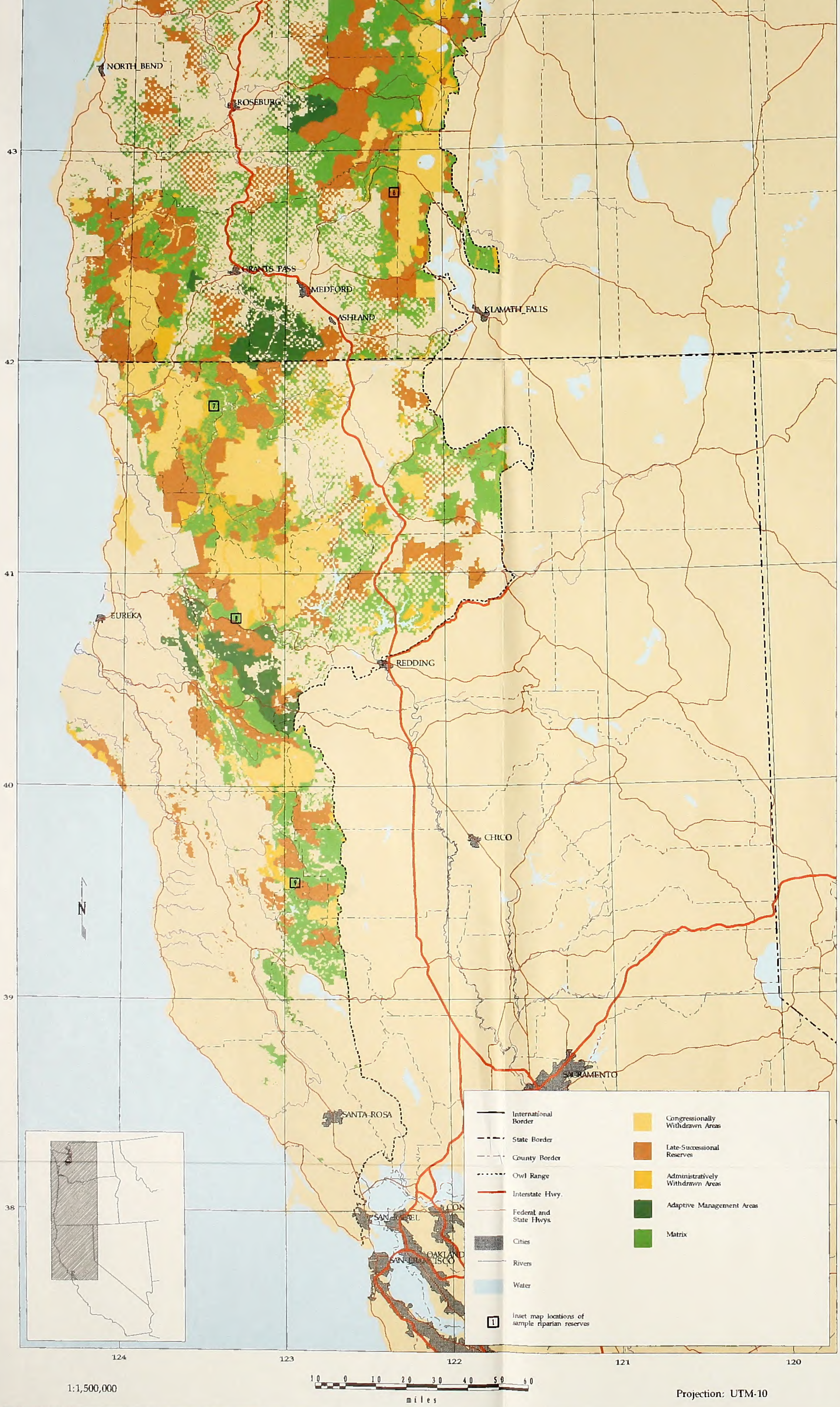
LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

RIPARIAN RESERVES are areas designated along perennial and intermittent streams and wetlands where cutting of trees is limited to silvicultural treatment of young forest with an objective of maintaining suitable habitat conditions for fish and other aquatic organisms.

ADAPTIVE MANAGEMENT AREAS are landscape units for development and testing of new approaches for integration and achievement of ecological, economic and other social objectives.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.



Projection: UTM-10

Ecological, Economic, and Social Assessment." This Option, like others in the assessment, is depicted for illustrative purposes for consideration by decision makers. Final boundaries and land allocations are subject to further revision as necessary to meet laws, regulations, and objectives. All land allocations apply only within the range of the northern spotted owl.

Major features:

CONGRESSIONALLY WITHDRAWN AREAS include National Parks, Wilderness, National Monuments, and other federal lands withdrawn from vegetation manipulation through Congressional designation.

LATE-SUCCESSIONAL RESERVES include all federal lands within a prescribed boundary where cutting of trees is limited to younger forest stands to accelerate the development of late-successional structures.

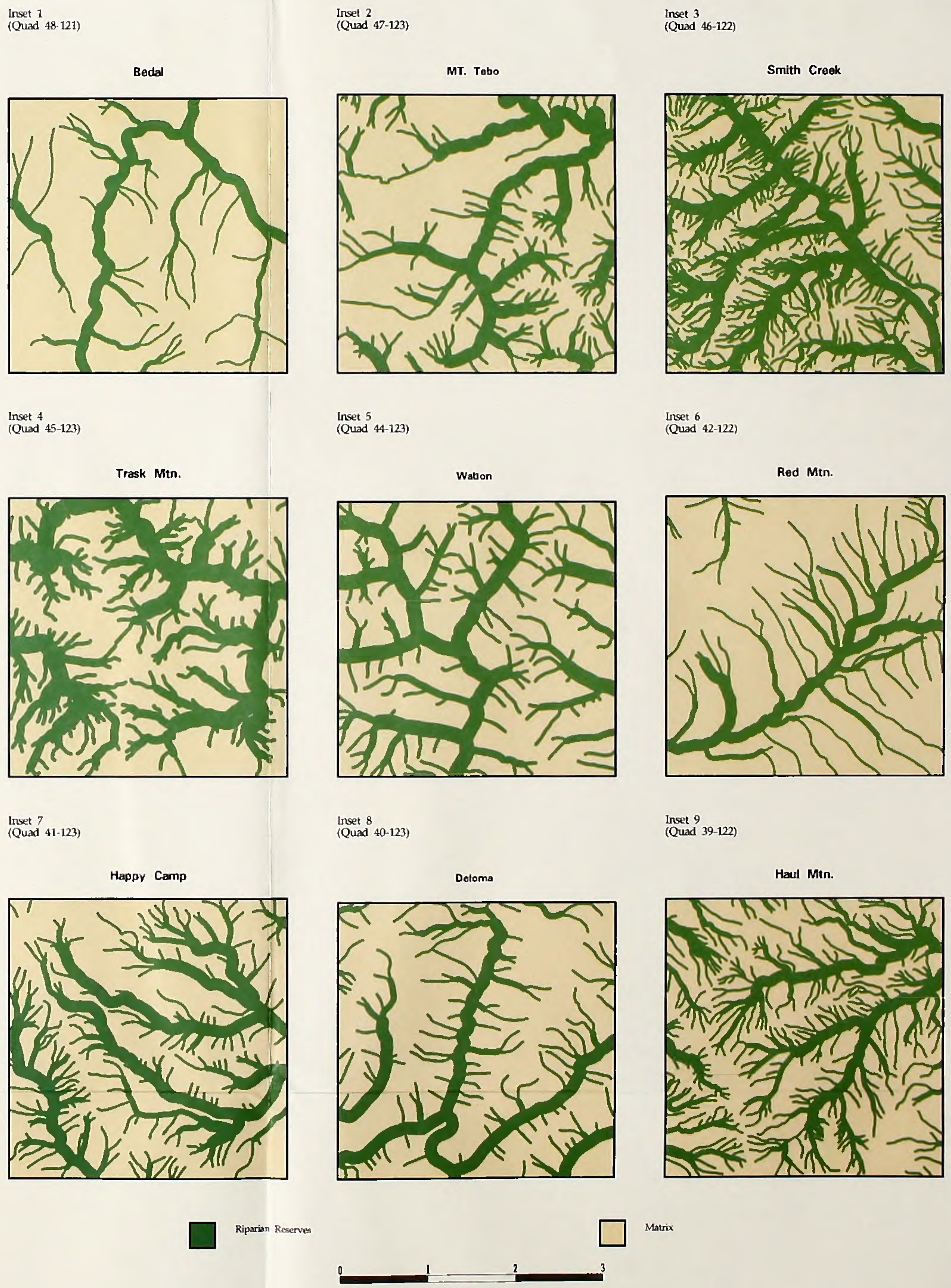
habitat conditions for fish and other aquatic organisms.

ADAPTIVE MANAGEMENT AREAS are landscape units for development and testing of new approaches for integration and achievement of ecological, economic and other social objectives.

ADMINISTRATIVELY WITHDRAWN AREAS are federal lands withdrawn from planned or scheduled timber harvest through administrative decisions. If timber is harvested in these areas, it does not contribute to allowable sale quantity. Such lands could be returned to the timber base pending results of further analysis and planning.

MATRIX is all the remaining federal land outside of Reserves, Withdrawn Areas, and Managed Late Successional Areas that are available for timber harvest at varying levels.

## Sample Distributions of Riparian Reserves



Inset numbers correspond to numbers within boxes in map. Quad numbers refer to lower right corner of the 1-degree latitude-longitude grid blocks.

No warranty is made for the use of these data beyond the purpose intended by the Forest Ecosystem Management Assessment Team